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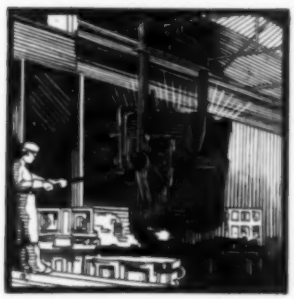
THE FOUNDRY

Established in 1892



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ADVERTISING PAGES REMOVED

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use less limestone, silicon and manganese; and get better castings—Easily done with

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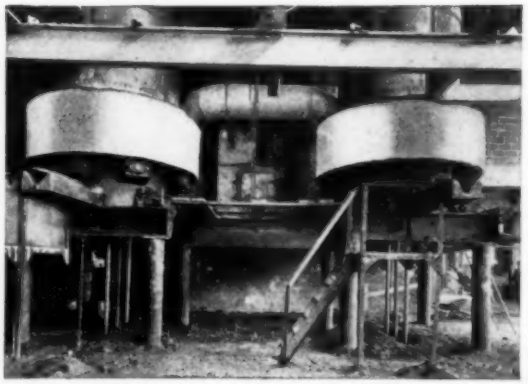
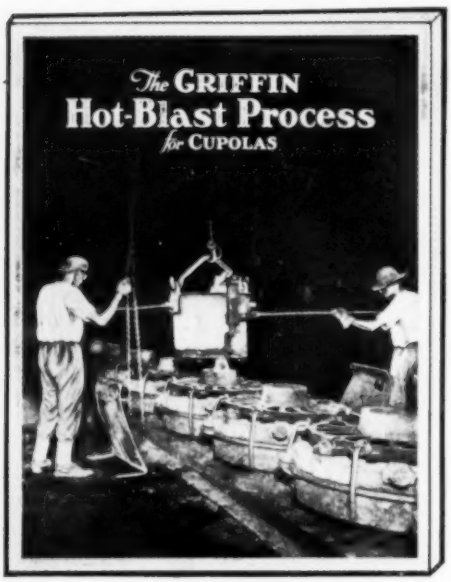


Griffin Hot-Blast Process applied to two alternately operated cupolas in the foundry of a large automobile plant.

With *hot-blast* operation, the liberation of the potential heat (carbon-monoxide) by the completion of combustion, and the extraction of this and the sensible heat from the stack gases in their passage through the blast heater provide heat for the melting of additional iron, with no equivalent increase in losses from the formation of slag, heating of the cupola, evaporation of the moisture, etc. The additional heat in the blast is therefore virtually 100 per cent available for transfer into the iron and so *much more valuable* than equivalent transfer from raw coke, that the Griffin Hot-Blast Process melts 13.5 lb. of iron from each pound of coke, in comparison with 9 lb. or less with cold blast.

Quite aside from this high transfer value, the returned heat, melting 50 per cent more iron but putting no more air in the cupola, subjects the melting and dripping iron and the elements, manganese and silicon, to one-third less air per pound of melt, and therefore reduces oxidation, and decreases the quantities of manganese and silicon that must be added to produce castings of the predetermined analysis.



The fuel, material and labor economy, better production and reduced rejection losses assured by the Griffin Hot-Blast Process have effected 50 per cent or greater net annual return on every installation, and can do more to sustain profitable foundry operation than will any other foundry improvement.

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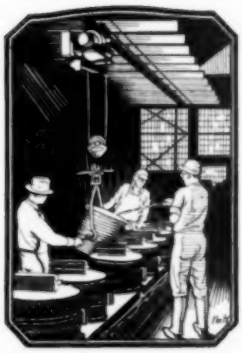
The GRIFFIN Hot-Blast Process



THE FOUNDRY for January

Meeting Your BANKER

ONE trade association executive of considerable acumen advances a thought on price cutting. He asks how a banker approached for a loan in the months to come will view the statement of some manufacturers, foundries say, that are indulging in this expensive pastime of selling their product below cost. With the exhaustion of assets, the use of every means to avoid the necessity of asking bank credit that now obtains, probably few think ahead to the day when a little assistance must be asked from the banks. When this time comes, new measure of credit must be applied. The depreciation in real estate and plant equipment assets is recognized. Is it not reasonable to suppose that the lender will ask some measure of business ability, some record of good management upon which to base an estimate of worth? How much collateral will be found in the profit and loss statement of a foundry that is selling below cost?

Medicine Men PRESCRIBE

LEGISLATIVE nostrums for business ills are in the making. Every political inanity that previously has seen the light of day and many newly invented are pushed forward in the crawling hives of city, state or national legislative bodies. The output is honey sweet and sticky to the voter, but cloying or emetic to the sick business world. Unemployment insurance, to use the misnomer for a hazard that permits of no actuarial analysis, is a favorite. The experience of Great Britain and of Germany fails to warn. The German plan inaugurated in 1927 incurred increasing deficits and loans from the government and finally collapsed in June, 1932. No form of employer-employe contributed fund and most certainly no tax supported government dole can withstand the pressure of a long continued period of depression. No individual, and no owner of a business should delegate to politically administered management the custody of savings or reserves against a period of enforced idleness. Unemployment cannot even be measured for insurance.

Substitute for WAGE CUTS

FOUNDRY managers under pressure from their owners to meet competitive prices are in a tight box. Many have cut wages to a point where they realize that with reduced hours of employment their men cannot subsist. Their own sense of justice, as well as business foresight will not permit further reductions. With some this is an insurmountable obstacle. With others it may be overcome. The introduction of machines that in themselves will permit economies is the course taken by those whose means permit. The absolute refusal to make any more castings below cost is the only other way out. The latter path if followed with firmness will have a direct influence on price structures. Coupled with the proper aggressive measures in relation to accounts of long standing, it cannot fail to stem the decline and induce a trend upward.

What's New in JANUARY

FORTY-TWO years production of steel castings and 1933 methods in a steel foundry of the automotive capital, (page 10). THE FOUNDRY in wartime, castings at the front and behind the lines, (page 13). Wisconsin foundries show the way to good plant housekeeping and solve the silicosis problem, (page 16). Saving heat, and money, by new insulation technique, (page 18). Economy and new uses through proper malleable design, (page 24). A castings show creates sales leads, (page 36).

Fig. 1—The daily average production of the electric furnace for an entire month last year was 25 tons of steel

Pours Steel Castings On Conveyors

By FRANK G. STEINEBACH

FOR the past forty-two years, the Detroit Steel Casting Co. and its predecessors have produced steel castings on the location of its present plant in the Western section of the city of Detroit. During all of this period that company has been collecting a vast amount of technical and practical information which has permitted the establishment of positive methods of control and thus enabled the continuous production of a quality product. Not only has the information been utilized in the service of the customer but the company has been active constantly in furthering the fortunes of the steel foundry industry through the interchange of valuable information with others engaged in similar pursuits.

As more knowledge was acquired in the technical phases of steel castings production and greater control was secured over many of the variables encountered in the work, changes have been instituted in the equipment of the plant. Advantage has been taken of important developments in modern machinery designed to produce a uniform quality product with a minimum of labor required for maintaining operations. During the last two years, numerous additions have been made to the equipment for molding, melting, handling, cleaning and heat treating.

The Detroit Steel Casting Co. manufactures steel castings ranging in weight from one-quarter pound to 20 tons, either in a high grade carbon steel or of any alloy combination that may be desired. The record of castings rejected by customers indicates clearly the success of efforts toward quality, as exercised by that company. Out of a total of over 1200 castings weighing 204 tons which were supplied one customer over a period of several months, a considerable amount of machine work on each casting failed to bring the total rejections over 0.07 of 1 per cent. During a two year period over 2600 tons of castings, which were of intricate design, were shipped to another customer and the rejection was considerably under 1 per cent. Records such as these stimulate interest in the equipment and methods employed at that plant.

Castings Produced in Two Shops

Foundry operations are allocated naturally into one of two shops by the classes of work produced. One shop, located in a wing at one end of the main foundry building, is devoted to the production, on molding machines, of small castings, ranging up to 20 pounds in weight. The larger shop handles the heavy work and, due to the type of work and methods of manufacture, the operations are divided into two sections. One end of the shop is devoted to the machine molding of castings used in railway car construction, for furnace parts, and any other type of work which will lend itself readily to production on match boards mounted on roll-over, pattern draw molding machines. The second section of the heavy shop produces a variety of large work in which the sandslinging machine is used extensively in making all molds.

The light castings shop is the most highly mechanized unit of the plant, although each department is well equipped with machines to

provide greater uniformity in control of products and at the same time reduce production costs. At present all work in the small castings shop is produced on nine molding machines, which are located along one side of the room, as shown in Fig. 2. The machines are the jolt-squeeze type, supplied by the Osborn Mfg. Co., Cleveland.

Uses Roller Type Conveyor

As may be noted in Fig. 2, two roller conveyors, 11 inches wide and located to give 50 inches between outside edges, slope from the molding machine station to the shakeout, a distance of approximately 75 feet. The conveyor was supplied by the Mathews Conveyor Co., Ellwood City, Pa. A bottom board about 6 feet long is supported on the two conveyors, a cleat on the bottom of the board resting on each set of rollers as shown in the illustration. Molds are made in slip flasks and the molder places from four to six molds on each bottom board, depending on the size of the mold. The loaded boards then are moved along easily toward the pouring station.

A pouring station extends the entire length of the foundry floor and is located about six feet from the shakeout end of the conveyor. As may be noted in Fig. 2, steel plates provide a firm footing for the men performing the pouring operations. Pouring is accomplished with shank ladles. After the castings are poured, the bottom boards are pushed across the pouring platform to that section of the conveyor which extends between the platform and the shakeout. The castings in the mold are allowed to cool a sufficient length of time, while the bottom boards move over the length of conveyor from the pouring station to the shakeout, and then are dumped on the shakeout grating shown in the foreground in Fig. 2, which is composed of steel castings especially designed and produced by the Detroit Steel Casting Co. Care was taken in the development of the grating to provide openings of sufficient size to permit the sand to fall through readily. At the same time, the opening has been made small enough to prevent the smallest work from falling through when the molds are dumped on the grating.

Fig. 3—Small castings are cleaned in a combination tumbling and blasting machine

Sand for the small casting shop is prepared and handled entirely by mechanical equipment. Sand that falls through the grating at the shakeout, is carried on a reciprocating conveyor to the middle of the shakeout, at the extreme left in Fig. 2, where it is dumped on a belt conveyor for transportation to the sand mixing and preparing department, located in a room immediately at the rear of the molding floor. The used sand is dumped into a bucket elevator and carried

Fig. 2—Molds are made on the machines in the rear, move forward on the conveyors to the pouring and shakeout stations

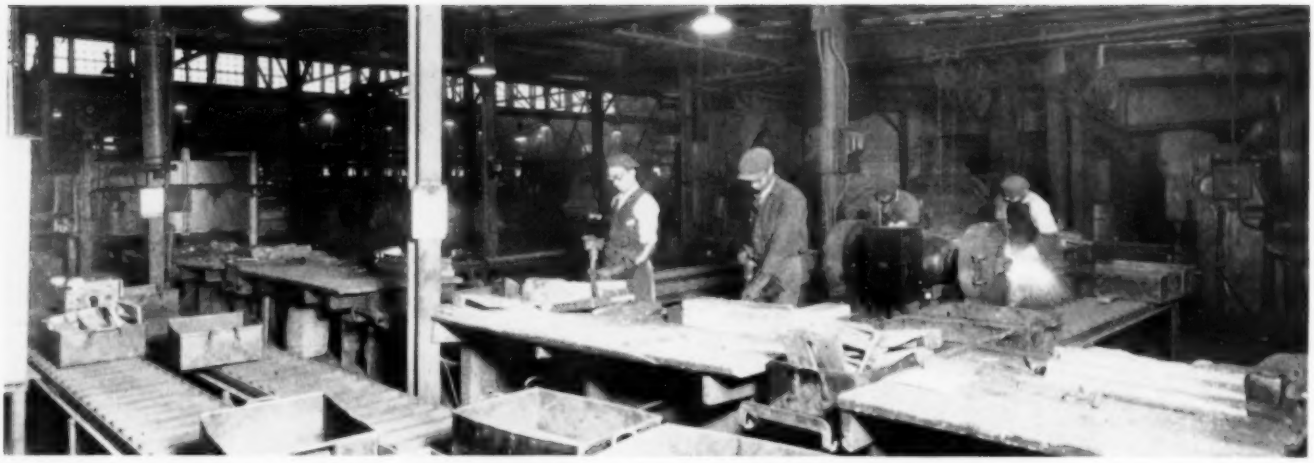


Fig. 4—Careful study of the arrangement of equipment in the cleaning room has facilitated greatly the movement of materials through that department

to a storage bin having a capacity of 50 tons. A smaller bin is provided for the new sand, both bins being arranged so that the sand may be discharged into the mixer.

Meter Controls Water Added

The sand mixture for the small casting shop is made of used sand, new Ottawa silica sand, bentonite and a cereal binder. Old sand, new sand and the binder are mixed in a muller type mixer made by the National Engineering Co., Chicago, and a definite amount of water is added, as indicated by a meter. When thoroughly mixed, the sand is discharged into a bucket elevator and is carried to a sand aerator at the top of the room. The sand is carried from the aerator to the distributing conveyor, then to the bins located immediately over the molding machines, as shown in Fig. 2. Twelve bins are provided so that three more machines may be added to the shop when necessary.

As is the case with all sand used in the foundry, fines are removed during the course of preparation. The company is more concerned in maintaining uniformity in the amount of fines included in the sand, than in removing them entirely, so that no attempt is made at the latter. In the small casting shop installation, the fines are removed by an arrestor of the cyclone type as the sand passes through the screen immediately before it is dumped into the used sand bin. The equipment for handling and storing sand in that shop was built by the Palmer-Bee Co., Detroit.

Metal for the small shop is melted in a 1½-ton electric furnace built by the Pittsburgh Electric Furnace Co., Pittsburgh, as shown in Fig. 1. Normally from 6000 to 9000 pounds of metal constitutes a heat for that furnace, but in cases of emergency, when the open hearth has not been in operation, the company has melted as high as 16,000 pounds of metal in one heat. Over 30 tons of metal have been tapped from the furnace in a 24-hour period, and the daily average for an entire month during the early part of last year was (*Please turn to page* 46)

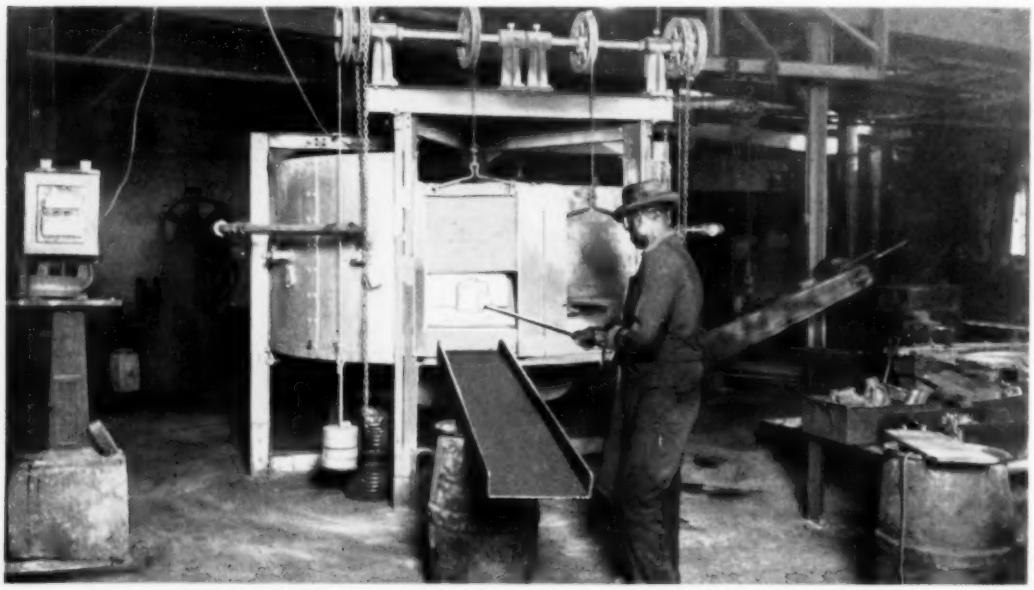


Fig. 5—Small castings are normalized in a continuous, rotary type furnace

Through the Years with

THE FOUNDRY

THE war was in progress. Nations of the world were digging in on the soil of France and Belgium and throughout Europe and Asia for a conflict that was to drag on four long and weary years. In the end, the world was to be changed, perhaps forever.

To America in general, the battle seemed far away. Everybody felt that this country would not be interested in the troubles of Europe. Yet, early in 1915, manufacturers of the United states began to feel the impetus of the enormous demand for war goods. In this the foundry industry was a leader. Castings were essential in the successful conduct of the war. They were needed for the factories at home, for ships, railroads, communication lines, for material and ammunition at the front and for a thousand other uses. Never before was the indispensibility of cast products so apparent.

Orders Exceeded Foundry Capacity

The new year found foundry operations not in excess of 25 per cent. But improvement began immediately and accelerated rapidly. Each issue of THE FOUNDRY reported a steady gain until late in 1915 it was pointed out editorially that "foundry operations in all branches of the industry are being carried on under high pressure, the avalanche of orders being greatly in excess of producing capacity." Even then, with the war only a year old and the maximum demand not yet approached, production capacity had been exceeded. Something had to be done.

Leadership of THE FOUNDRY proved of vital importance in this emergency. On its pages appeared many articles showing in great detail the methods followed by leading foundries—gray iron, steel, malleable and nonferrous—in increasing output and speeding production. New equipment for performing practically every operation in the foundry was described and the advertising pages carried valuable information on available equipment and supplies. Undoubtedly, meeting production demands was the big news of 1915 and 1916. In presenting this phase, the editors of THE FOUNDRY, consciously or unconsciously, were preparing the American foundry industry for its greatest service to the nation.

Attention to safety and good housekeeping problems probably was the second most important news feature of the industry during 1915 and 1916. Many articles were published covering various phases of the situation, including the following: "How State Laws Compel Removal of Dust"; "A Light and Practical First Aid Jar for Foundries"; "Safety in Tumbling Mill Operations"; "Good Light, a Safety Factor in Casting Plants"; "Proper Protection for Barrows and Trucks"; "Intoxication, a Cause of Foundry Accidents"; "New York State Rules Governing Casting Plants"; and "How To Increase Safety of Cupola Operations."

Application of the electric furnace to steel foundry melting was attracting attention about that time. An article in the January, 1915 issue by H. Cole Estep and entitled "Electric Steel Castings Made on Large Scale," stated that "considerable interest is attached to the new foundry of the Otis Elevator Co., Buffalo, because it represents a serious atempt to make electric steel castings on a scale comparable with open-hearth practice." Later in the year an electric furnace installation at the Lebanon Steel Foundry, Lebanon, Pa., was described, while the following year an article on "Application of the Converter and the Electric Furnace in the Production of Steel Castings" gave further information on the subject.

Teaching Foundry Practice by Mail

An intimate knowledge of foundry practice coupled with a desire to serve the great body of young men of the castings industry, had led David McLain to organize an interesting system of foundry education at Milwaukee. In February, 1915, THE FOUNDRY told of the valuable work that was being accomplished by Mr. McLain's school in an article entitled "Teaching Foundry Practice by Mail." In this, as in many other instances, THE FOUNDRY was only leading the way, for some years later one of the leading popular magazines of the country saw fit to publish a human interest sketch of Mr. McLain's career of service.

The idea of heat treating gray iron castings had been under consideration and certain plants were working in that direction. An article in the May, 1915 issue on "Annealing Gray Iron Castings" desribed the ovens used by the Brown and Sharpe Mfg. Co., Providence, R. I., and pointed out that "the annealing process apparently softens the castings through the precipitation of some of the combined carbon as graph-

ite." A little later the results of heat treatment on the softness, strength and microstructure of light iron sections were discussed in "Annealing Effect on Light Gray Iron Castings."

In April 1916, THE FOUNDRY carried the following announcement: "C. E. Hoyt of Chicago, formerly secretary of the Exhibition Co., has been appointed manager of the exhibit of foundry equipment and supplies, which will be conducted under the auspices of the American Foundrymen's association and the American Institute of Metals, concurrent with the convention of these two organizations at Cleveland during the week Sept. 19." The wisdom of that choice is well known today, for not only has Mr. Hoyt been responsible in a large measure for the success of the valuable exhibitions of foundry supplies and equipment which have been held since that time in various parts of the country, but through his leadership, the American Foundrymen's association constantly has served in furthering the progress of the industry.

The Foundry Senses Responsibility

But the storm which had broken out in Europe two years previous was spreading and war clouds were threatening America. Sensing the responsibility that was about to fall to this basic industry, the editors of THE FOUNDRY published an editorial in the April, 1917 number, under the heading of "A Call To Duty," which referred to "events that appear to be leading inevitably to war." The same issue also carried articles on "The American Foundry in a Time of War" and "Molding Shells and Grenades for the French Army."

The feature of the May, 1917 issue was an article on "How the Foundry Industry Has Prepared for War." "Prepared for any eventuality! That is the answer of the American foundry industry to Uncle Sam's call for aid in the present crisis," was the theme of the declarations. The following month the editors of THE FOUNDRY warned that "American Foundrymen will be called upon to solve new problems in producing castings for the government's huge war program."

The spirit of service to country prevaded the annual convention and exhibition of the American Foundrymen's association which was held in Boston the week of Sept. 24. The keynote of the meeting, according to THE FOUNDRY, "was unstinted, unmeasured service to the government concentrated to one end—*Victory.*" Resolutions were adopted authorizing the president of the association to appoint a War Service board to work directly with the different agencies of the government; pledging co-operation in the sale of liberty loan bonds; and extending the support to all members of the industry to the work of the government.

In the midst of such feverish activity, THE FOUNDRY passed its twenty-fifth milestone. Celebration of the first quarter century of service to the foundry industry occasioned a general review of foundry progress in the September, 1917 issue. John A. Penton, founder and first editor recalled early experiences of the magazine in an article "How The Foundry Was Dressed When it Made Its Bow 25 Years ago. The late A. O. Backert, at that time editor of THE FOUNDRY and later President of the Penton Publishing Co. discussed the service of the paper to the castings field in an article entiled "The Foundry Parallels Iron Industry's Progress."

In the same issue, leaders in the foundry field commented on various phases of the industry in the following articles: "Gray Iron Progress in 25 Years," by W. J. Keep; "Progress in Foundry Equipment Manufacture," by J. H. Whiting; "Malleable Iron Improves in Quality," by Enrique Touceda; "Progress in Malleable Iron Manufacture," by J. P. Pero; "Growth of the Foundry Supply Business," by Frederic B. Stevens; "How Gray Iron Has 'Grown' in 25 Years," by Alexander E. Outerbridge Jr.; "Malleable Foundry's Quarter Century Survey," by Richard Moldenke; "Supplying the Foundryman for 25 Years," by John Hill; "Progress of Steel Founding in 25 Years," by R. A. Bull; "Semisteel in the Last Quarter Century," by David McLain; "What the Brass Foundry Has Done in 25 Years," by Charles Vickers.

Reviews Early Foundry Activities

As time marched on, war demands gradually became the controlling force of the foundry industry. The general atmosphere which this created, led to expeditions into certain phases of castings history. An interesting article by Job Goostray entitled "Casting Large Guns in the Early Eighties," was presented in the January, 1918 issue. History pertaining to peace was reviewed a little later in an article "The Evolution of Cooking and Heating Stoves."

The problem of manufacturing grenades in large quantities rapidly was being solved, and in February, THE FOUNDRY described clearly how a daily average production of 25,000 malleable cast iron rifle grenades was attained by Benjamin D. Fuller at the plant of the Westinghouse Electric & Mfg. Co., Cleveland. But not all grenades were intended for the troops in France. To conserve production capacity of regular foundries, the foundry department of the Kansas State Agricultural college filled an order for dummy hand grenades for Camp Funston, thereby facilitating training of the embryonic doughboys.

Of course the war was providing an unexpected impetus to a small and struggling aircraft industry. Planes were needed, not only by our own army, but also by our allies. Since castings were needed (*Please turn to page* 49)

Deoxidizers for Brass Alloys

Manganese lessens fluidity of the alloys making it necessary to add another agent

By CHARLES VICKERS

WHILE manganese is used considerably as a deoxidizer of red and yellow brasses, it is not used as extensively as phosphorus for that purpose ,and not, as a rule, in the same types of alloys. One reason for this is that manganese acts differently than phosphorus. Instead of increasing the fluidity of the metal, the author has found it has the opposite effect and will diminish it.

Manganese for foundry use generally is sold as an alloy with copper; the 30 per cent manganese, 70 per cent copper being standard. Two grades, namely the *A* grade and the *B* grade are available. The former usually is referred to as the iron-free grade, while the *B* grade, made with ferromanganese, contains more iron, the amount depending upon the grade of manganese used. Thus a low-iron ferromanganese made in the electric furnace can be obtained which contains about 80 per cent manganese, 12 per cent iron, 1.0 per cent silicon and 7 per cent carbon.

Manganese Dissolves Readily

The *A* grade manganese copper, made from No. 1 grade manganese, contains a little iron as it is made from the dioxide which never is iron free. In that respect it resembles aluminum, which always contains iron. Iron is an impurity in the raw material which would be too expensive to remove for ordinary purposes. The high grade manganese metal now obtainable is not difficult to alloy with copper as the manganese dissolves in superheated copper when the two are melted together much the same as in the case of nickel and copper in making alloys of those metals.

Opinions differ regarding the amount of manganese to use as a deoxidizer of copper alloys. One writer refers to an alloy containing 87 per cent copper, 10 per cent tin, and 3 per cent of 30 per cent manganese copper as a good alloy for gears. He states that some difficulty is experienced in casting that alloy. The author has found that manganese in that amount will cause misruns in castings made in sand molds unless either aluminum or phosphorus also is added. Usually much less manganese is used.

Manganese and phosphorus can be used together without detriment to the metal. For example, a copper bar 1¼ inches square by 6 inches long was cast in sand. The foundryman added 0.5 per cent manganese copper to the metal and this was followed by an addition of 0.5 per cent of phosphorus copper containing 15 per cent phosphorus. The casting presented a good appearance and no pits were visible on the surface. The copper was extremely fluid, as could be expected with that amount of phosphorus.

Alloy Prepared as Shot

Some foundrymen, having their own ideas on how to use manganese as a deoxidizer in copper-tin and copper-tin-zinc-lead alloys, secure excellent results. Many consider the 30 per cent manganese alloy too rich, and scale it down in some cases to an alloy of 5 per cent manganese content, of which 0.5 per cent is used. This is accomplished by melting 83 pounds of electrolytic copper with 17 pounds of 30 per cent manganese copper, and either making it into shot or pouring it into thin strips which can be cut into small pieces weighing about ½-pound each by the sprue cutter. The alloy may be made into shot by pouring into water. A metal barrel half filled with water is used for the purpose and the bunghole is left open as an overflow. A hose is arranged so that the stream of water will whip the surface of the water in the barrel during the time the molten stream of metal is poured slowly into the water. After the shot has been dried, it is handy for making up the weights of the alloy required.

Manganese of course is used in the copper-zinc series of alloys comprising the manganese bronzes. Some of these alloys carry only a few tenths of a per cent of manganese, while others contain several per cent of manganese. The present type of manganese bronze supplanted the copper-tin alloys previously used as metal for propellers after the improvement made by the addition of aluminum was discovered.

In making a copper-tin type of manganese bronze it is nec- (*Please turn to page* 54)

Good housekeeping should be an earnest endeavor at all times

Wisconsin Foundries Co-operate

Group action affords protection and points to preventive procedure in solving silicosis problem

By E. O. JONES
Belle City Malleable Iron Co.

IT IS interesting to note that while pneumoconiosis and silicosis have, in some countries, been prevalent in various industries for many years, it was not until 1931 that legislation was enacted which would affect the foundry industry in its entirety. Within this short space of time, we in the foundry industry were suddeny confronted with a health hazard which we were not aware actually existed.

Now to what extent does this health hazard actually exist in the foundry industry? We will review just what has taken place in the state of Wisconsin and how the foundry industry of this state is attempting to solve the problem.

In the state of Wisconsin what constitutes occupational disease is left entirely to the industrial commission. There are of course many difficulties confronting those who are responsible for rendering decisions growing out of the claims for occupational diseases:

1. They must consider and decide whether the employe has been subjected to the health hazard which would bring on the disease for which he is filing claim;
2. Whether he has the disease; and
3. If he has it, what amount of disability should be allowed.

During the latter part of November, 1930, our industrial commission notified the industries of our state that due to the increasing number of silicosis claims filed, they proposed to publish a code covering dust, fumes, vapors and gases. The first reading of this code was held on Dec. 4, 1930.

At that hearing many discrepancies in the proposed code, relating to dust, were pointed out by the representatives present from our industry. Perhaps the most glaring of these was the proposed schedule for the maximum allowable

concentration of silica dust under ten microns in size, present in a cubic foot of air. The maximum count permissible, according to this code, was 250,000 particles, which would be less than what one might find in the atmosphere of any city street. When we think of dust we ordinarily think of that which we can see. The dust particles which are of interest to us are not usually visible to the naked eye. A piece of 280 mesh screen would permit the passage of particles 50 microns in diameter, five times the maximum size of silica particles held to be dangerous.

Immediately after this hearing a general meeting of foundry representatives was called by the Wisconsin Manufacturers' association to acquaint our industry with the havoc which this proposed code would create if adopted in its present form. At this meeting a committee of seven foundry executives, with Harold S. Falk, vice president and works manager, Falk Corp., Milwaukee, as chairman, were appointed for the purpose of combating the dangerous situation with which our industry was confronted.

Mr. Falk and his committee did a commendable piece of work and our entire industry is indebted to them for their conscientious and untiring efforts to bring about a program which would be identical in purpose with that to which the foundry industry had directed and were directing its efforts.

Assist in Drawing Up Code

The initial step in this committee's activities was to call upon the members of the industrial commission to solicit their co-operation in formulating a program of research which would in turn assist the commissioners in drawing up a code which would be practicable and workable in its application. In this they were successful and the necessary funds were solicited from the companies operating foundries to start a survey to determine the most satisfactory and effective means of reducing or minimizing any excessive dust conditions then prevailing.

Clarence Bartlett, an industrial engineer, was employed by this committee to make the preliminary survey. When this work was completed in a representative number of foundries, the report showed that regardless of the merits or shortcomings of the proposed code, there was apparently a large amount of dust being created unnecessarily in our manufacturing processes. What percentage of this dust was under 10 microns in size was the next question. Pathologists tell us that particles over 10 microns in diameter are seldom found in the human lungs.

Through the courtesy of some of the firms who carried their group and health policies with the Metropolitan Life Insurance Co. we were able to appeal for help through their policyholders' service bureau. This bureau maintains a department of hygiene which has devoted considerable time to the study of dust and its affect on human life. The Metropolitan immediately responded by placing at the service of this committee, the personnel of their hygiene department.

On May 31, 1931, the second stage of this program was taken up by the personnel of this department and completed a few months later, with 21 representative foundries participating in the work. The study was grouped into four general classifications: gray iron, steel, malleable and nonferrous.

Two hundred fifteen (215) x-ray examinations were made of chests of workers exposed to foundry dust. These workers were selected from locations where dust concentrations were the highest. Dust samples were taken at various places of employment, and process analyses made, as well as sanitary conditions noted.

Provides Medium of Measurement

After the study was completed in each of these foundries, the management received a report of the conditions as they were found in his plant. Photographs were included showing how and where the dust sample was collected. The results of the dust counts taken were charted to show the sizes of the dust particles, ranging from 10 microns to under 1 micron in size. When the entire study was completed, each of the firms participating received a composite report. This report was published in code and no photographs shown which would serve to reveal the identity of any of the companies contributing. This report served the further purpose of giving a complete picture of dust concentrations under 10 microns in size as they were found in our various occupations in the foundry and provided Mr. Falk and his committee with an effective medium of measurement.

While this part of the program was in progress, the industrial commission suggested that one foundry be selected as an experimental laboratory to test out the practicability of suggestions for dust prevention as they were made. Mr. Falk kindly offered the use of their foundry for this purpose.

On Dec. 4, 1930 as mentioned, we were informed a new code was in the making. On May 15, 1931 the Metropolitan study was started and on Sept. 10, 1931 we were informed that there were pending before the commission, claims for silicosis amounting to approximately $600,000. Some foundries had as many as six cases filed against them and not any of these were confined to any one occupation.

It is significant to note that the majority of these cases were being handled by the same law firm, and furthermore, that the diagnoses were being made by the same doctors. This situation naturally disturbed our industry as from investigations it became increasingly apparent that few doctors were (*Please turn to Page* 50)

Fig. 1 — Insulated type ladle delivering iron to the electric furnace. The cover for the receiving spout of the furnace also is shown

Uses Insulated Covered Ladles

Malleable iron automotive foundry develops equipment to handle molten metal in shop

By D. O. THOMAS
General Motors Corp.

THE majority of ladles now being used for the handling of molten iron consist of a steel shell with a suitable refractory lining. Invariably these ladles have relatively thin walls and are open completely at the top. This provides favorable conditions for the rapid cooling of the molten iron. Therefore, it is quite necessary that the iron in these ladles either be handled rapidly, or superheated to provide for the drop in temperature while handling. This superheating is expensive both in initial cost and operation.

Present melting process at the Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., is that known as the cupola-electric duplexing process, in which the charge is melted in the cupola and superheated in the electric furnace. During the past six months there has been developed in that plant, an insulated and covered ladle which greatly reduced the amount of superheat required in the electric furnace, due to eliminating the major part of the

Fig. 2—Iron is tapped from the electric furnace into a new type bull ladle

heat lost with the old type ladle. In addition, certain changes in the charge and operation of the cupolas have increased the tapping temperature at the cupola spout by approximately 100 degrees Fahr. This has further reduced the superheating required.

The dotted line in Fig. 4 is a time-temperature curve showing the temperature change of the iron from the time it was tapped at the cupola spout until it finally left the old type pouring ladles. The cupolas were tapped at approximately 2690 degrees Fahr. and the iron allowed to stand in an open type forehearth while being desulphurized. As iron was required at the electric furnaces, these forehearths were tapped into an open type 3-ton bull ladle at approximately 2560 degrees Fahr. and transferred to an electric furnace for superheating to 2900 degrees Fahr. Correction for analysis was made as the iron went into the furnaces. The superheated iron was then tapped into open type bull ladles of 1½ ton capacity, and distributed to the open type pouring ladles of 500 pounds capacity. The last iron from these bull ladles would go into the pouring ladles at approximately 2735 degrees Fahr. The temperature would then drop to 2540 degrees Fahr. by the time the last iron was leaving these old type pouring ladles. Experiments showed that around 2650 degrees Fahr. the fluidity of this particular iron began to drop quite rapidly. Therefore, it was frequently necessary to *pig* iron from the pouring ladles instead of pouring it into the molds.

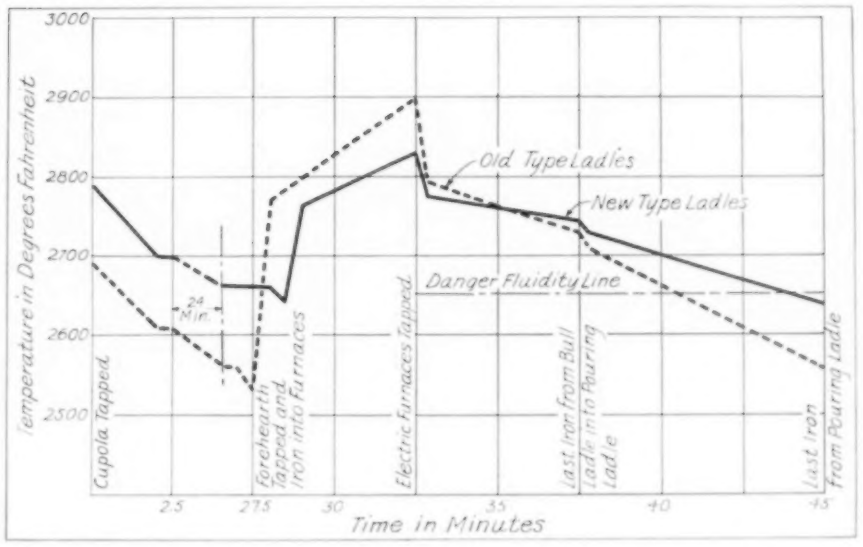


Fig. 4—Chart showing temperature change of the iron from the time it was tapped at the cupola spout until poured in the molds

The solid line in Fig. 4 is the time temperature curve covering the same handling of iron with the new covered and insulated type ladles. Iron is now tapped from the cupola at approximately 2790 degrees Fahr. into the forehearths, which have been covered completely except for a small 9 x 24 inch slot. The new 3-ton insulated type ladle which receives iron from the forehearths is shown in Fig. 1 delivering iron to the electric furnace. The cover for the receiving spout of the electric furnace may also be seen in Fig. 1.

Iron after being delivered to the electric furnace is superheated to approximately 2830 degrees Fahr. and tapped into the new type 1½ ton bull ladle as shown in Fig. 2. Fig. 3 shows the same bull ladle delivering iron to one of the new type pouring ladles and also one of the new

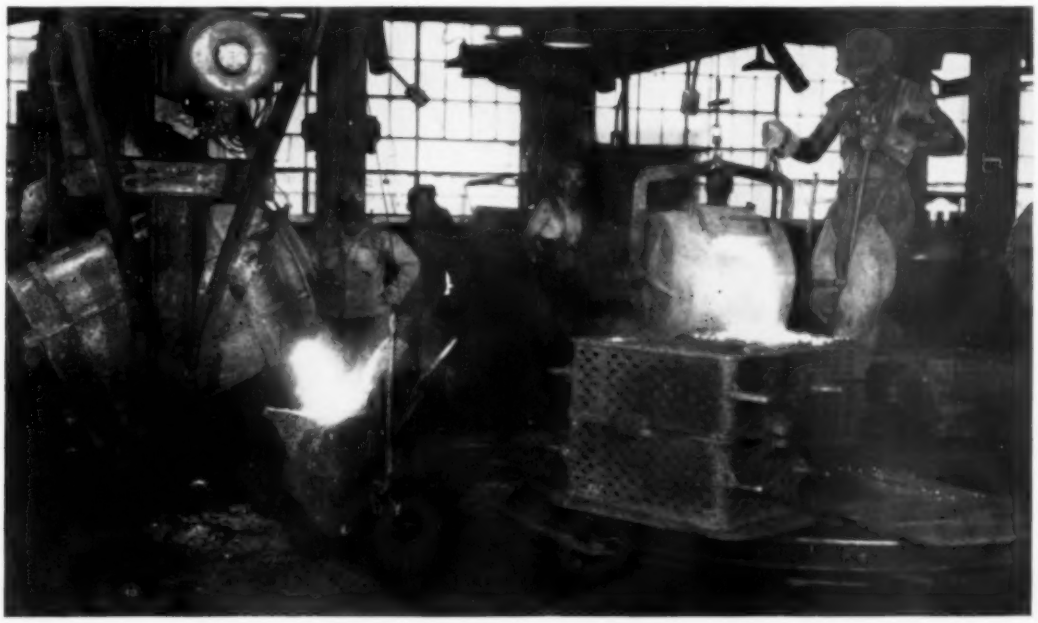


Fig. 3—Same bull ladle as shown in Fig. 2 delivering iron to one of the new pouring ladles

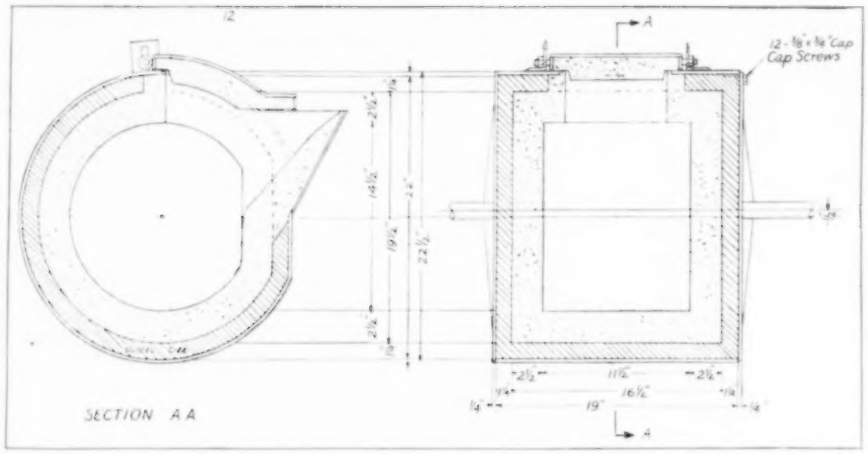


Fig. 5—Construction details of new type of pouring ladle

type pouring ladles in service on pouring conveyor.

Fig. 7 is a close-up view of the new type insulated and covered pouring ladle. It is interesting to note, in comparing the new ladle with those ordinarily in use, that a heat deflector is necessary for protecting the iron pourer from the open top of the old type ladle. Fig. 6 shows a 1½-ton bull ladle completely rammed up and ready to go into service in handling metal in the foundry.

Lining Rammed in Place

The general construction details of the new type pouring ladle is shown in Fig. 5 and consists of 2½-inches of refractory backed up with 1¼-inches of insulation and a ¼-inch metal shell. This shell is lined first with the insulating brick. A removable form then is inserted and the refractory wall rammed into place. The form is removed and the refractory for the one closed end rammed in. The cover for the open end then is fastened on, and the insulating brick and refractory for this end is placed through the 8 x 8 inch opening and spout. The construction of the 1½-ton and 3-ton ladles is practically the same, except for an increase in thickness of the refractory wall, and the use of an additional removable form for ramming the top.

The average life of the new type pouring ladle is 23 actual pouring days as compared with a 4-day life of the old type. Although the relining cost of the new type pouring ladle is three times that of the old ladle, the actual cost per day of service for this new type ladle is only half that of the old type ladle, due to its much longer life. The new type ladles require practically no patching except around the opening and at the spout. The covers for these pouring ladles require some patching and have an average life of 8 days.

The average life of the new type 1½ ton bull ladles is 14 days as compared with 4 days for the old type ladle. The relining cost of the new type ladle is four times that of the old type ladle.

Due to oxidation and slag action, it was found more economical to use a different refractory for the top of the bull ladles than that used for the side walls and bottom. The covers for these bull ladles have an (*Please turn to page* 53)

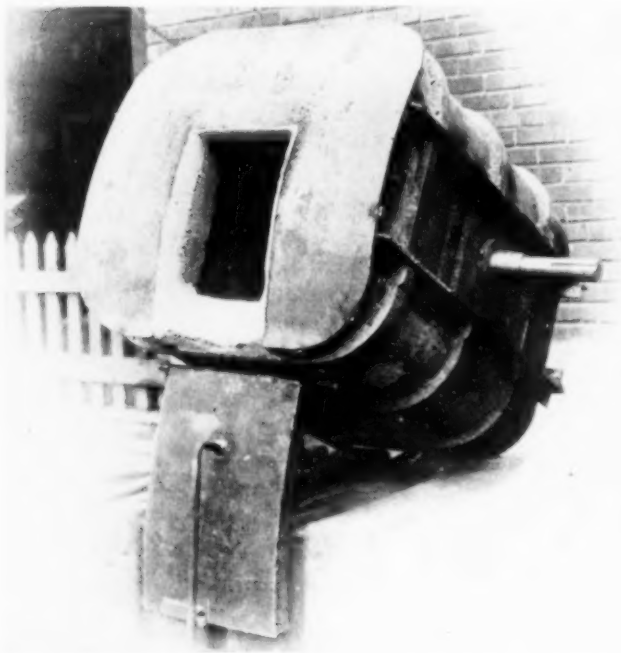


Fig. 6—Close up view of 1½ ton bull ladle completely rammed up

Fig. 7—Construction of the new insulated covered pouring ladle

Special Steels for Castings

Countless combinations give desirable properties after proper heat treatment

By R. A. BULL

DURING the past 15 years there have been many important developments, primarily in respect to chemical composition, and secondarily (as to the total number of procedures originated) in respect to heat treatment, for the manufacture of steel castings. Yet this progress has occurred without much in the way of public announcement to indicate it. There is a logical reason for this, lying in the cautious disposition of those who may consistently and without uncomplimentary criticism be called *alloy amateurs* among steel founders. These men, wisely, are inclined to go slowly in announcing the physical property values that they are willing to meet day in and day out, as rejection limits for their castings.

Pioneers Blazed the Trail

It is to the credit of such concerns as have been listed for many years among the successful producers of alloy-steel castings that they blazed the trail in connection with the most significant phase of development latterly characterizing the steel-casting industry. But the mere fact that 10 years ago there was a relatively small number of steel-casting plants that manufactured alloy-steel castings to appreciable extent, does not of itself justify censure of the majority of steel founders on the grounds of unprogressive spirit. It should be kept in mind that, until the World war terminated, comparatively few consumers of steel castings manifested keen interest in obtaining combinations of physical properties in steel castings more impressive than those typical of the garden variety of the steel foundry's product. Among the largest consumers of steel castings during a normal cycle of years, the railroad systems take prominent rank. Collectively speaking, up to a few years ago they did not indicate their need for higher physical properties than those regularly found in common or carbon steel for the castings employed for much of their rolling stock.

Times have changed since the World war in very important respects, industrially as well as morally and politically. The conflict operated to establish the degree of service dependability of many products and to stimulate users of such parts to study economy in the long run, in metals selection.

Coincident with the growing development of an alloy-steel consciousness among large consumers of wrought and cast products, there was an important industrial growth, in the establishment of relatively small manufacturing concerns which have found it advisable to utilize steel castings, in small or moderate tonnages. In the aggregate, the quantities so required are impressive and are increasing constantly, when general business conditions are normal. This has stimulated greatly the production of alloy-steel castings.

To serve the purpose of production, often calling for a special cast-steel product in a relatively small tonnage, numerous small melting units were needed. Accordingly, we have seen the installation of a great many electric furnaces during the last 10 or 12 years, admirably adapted from technical and economical standpoints for the production of special steels for castings. At present, out of perhaps 280 plants in the United States producing steel castings, more than half have one or more electric-arc furnaces installed. During the last 5 years the electric branch of the industry has witnessed the birth, commercially speaking, of a new small subdivision of its own branch resulting from the installation of induction furnaces.

Electric Furnace Meets Conditions

It is superfluous to dwell upon the fact that, while special steels in small quantities may be produced in converter and in crucible-furnace units, the latter types now are used frequently, largely but not wholly for reasons of economy. And it should not be inferred that steel-casting manufacture is not carried on satisfactorily in plants equipped only with an open-hearth or another form of melting unit. The condition putting the electric furnace prominently into the alloy-steel-casting picture is one of restricted heat size and of holding capacity of the furnace, associated with typically small, separate con-

sumer demand, and with production cost, affected by continuity of furnce operation.

The author has used the term *special* instead of *alloy* in the preceding comments. Some persons use these words synonymously. There have been differing opinions as to where to draw the line between carbon steel and alloy steel. Gradually there is developing a consensus of opinion which probably will serve before long to dissipate some confusion among purchasers of steel castings. For the purpose of the present paper (barring exceptions to be mentioned), the author will employ synonymously the terms *special* and *alloy* and the terms *common* and *carbon*, applying these terms in respect to steel for castings and not with regard for the characteristics of steel used for rolled or forged parts.

Manganese Steel Is Quenched

Mention has been made of heat treatment as a secondary phase of the special steel development, in respect to the number of procedures applied. It is interesting to recall that the development of the first variety of alloy steel that became prominent commercially was accompanied by heat treatment in a most essential way. Reference is here made to the well-known grade of steel, admirable for many purposes, called austenitic manganese, or Hadfield's manganese, or high manganese, depending on the preference of the individual. It was originated about 50 years ago. As many engineers know, this steel in the condition as cast is perfectly useless for ordinary structural purposes, and is made valuable to industry only by liquid quenching. Thus heat treatment played a vital part in the commercial development of alloy-steel manufacture for castings. It will continue to be an inseparable feature for the many varieties of alloy steels used where high mechanical stresses predominate.

Heat treatment becomes much less important as we get into the realm of certain high-alloy steels developed for resistance to corrosion and to high temperature. Here again there is some difference of opinion as to proper nomenclature; certain individuals preferring to classify as *irons* rather than as *steels* some of the complex alloyed materials containing high percentages of elements besides iron. Some grades of high-alloy metals made in the steel foundry (and for convenience herein classified by the author as steels) are characterized by a percentage of iron less than 50 per cent and contain large proportions of chromium and nickel, one or both.

In the structural field where severe stresses are encountered, unaccompanied by excessively high temperatures or by corrosive conditions (or by both kinds of these destructive factors), and where, consequently, the highly alloyed product is not required, there is a steadily increasing number of useful combinations, impossible for anyone to list completely due of course to the widespread spirit of research actuating many of the plants producing steel castings in the United States today. Naturally, the results of numerous investigations in these foundries are not made known generally for a considerable period, due to the wise precaution to carefully check results obtained by a sufficient number of tests.

The enormous number of combinations possible to employ, within the realm of possibility as viewed by an experienced metallurgist, may not be appreciated perhaps without mentioning the fact that occasionally there are as many as eight intentionally introduced elements, in varieties of alloy steels made for castings, while of course there are always present in addition small amounts of phosphorus and sulphur, and occasionally nitrogen. The range within which one may, in the alloy-steel foundry, produce material of established utility or of possible advantage, in respect to each of many elements, is great. For example, apparently satisfactory results from castings made in the steel foundry have been obtained, when producing material containing proportions of elements as low and as high as the following figures: Carbon, 0.05-3.00 per cent; manganese, 0.05-4.00 and 10.0-15.0 per cent; silicon, 0.08-3.00 per cent; nickel, 0.15-35.00 per cent; chromium, 0.15-30.00 per cent. The author has left a gap in respect to the manganese content in the preceding listing. There appears to be a large unexplored field below the percentage of manganese which develops austenitic structure and above the proportion frequently employed for producing several meritorious varieties of alloy steels (pearlitic or sorbitic) for structural purposes requiring great strength, ductility, chock toughness, and fatigue resistance.

Steels Resist Abrasion

In respect to the proportions of nickel and chromium given, probably it will be understood that the ranges extend from simple alloys used for structural applications to varieties of highly alloyed products (frequently not called steel, but often made in the steel foundry) which must show marked resistance to corrosion or to oxidation under high-temperature conditions. Resistance to abrasion or to erosion may be a factor in either of these two roughly differentiated groups. No range that has been mentioned is stated with the intention of presenting an authoritative limitation. The percentages should be regarded as approximate and as given only to indicate the hugeness of the task assumed by the steel-casting industry during the last 10 years, to find out by actual experiment what properties result from combinations reasonable to consider from the standpoints of first cost and economical service.

One may never wise- (*Please turn to page* 44)

When Annoyed To Exasperation

It may be well to throw overboard the old belief that the customer is always right

By ERIC N. SIMONS
Edgar Allen & Co. Ltd., Sheffield

IF YOU read those journals dealing with problems of salesmanship, you will find recurring with all the persistency of a much advertised slogan, a suggestion that "the customer is always right," and a perpetual deprecation of ill-temper on the part of either the salesman or the letter writer. In the main, this is an excellent principle on which to act, and one not to be departed from without excellent reason. But the purpose of these notes is to show that there are occasions when it pays to drop the conciliatory attitude, and without any further beating about the bush, to let the offender have the full force of the foundry's righteous indignation.

The Customer Was Satisfied

A case in point occurs to my mind. A salesman had been supplying a certain firm for many years with a type of casting requiring particular care on the part of the user to get the best results from it. This special attention was not required because of any special intricacy in the product, since the competing castings would have needed similar care. The salesman was friendly with the buyer, and with several other officials of the company. Everything pointed to their remaining one of his best customers for the rest of his life. They were perfectly satisfied with the castings, and the buyer refused to look at any others.

In course of time, as happens even to buyers, this one died. His place was filled by a new man, and a few months afterward a rift appeared in the lute. A big batch of castings was returned as defective. The salesman heard about it, and both he and the sales manager wrote very apologetic replies. So certain were they that the castings must be wrong, that they mailed these replies before ever the goods had been examined by the technical experts. Only once before had this firm ever returned any castings, and then they had been justified in doing so. It seemed fairly safe to assume that "the customer was in the right."

The foundry manager saw things in a different light. It did not please him at all to get curt notes from the vice president implying keen criticism of his ability to produce good castings. He tackled those rejected goods with a vicious determination to find out where and why they had gone wrong. He emerged from this investigation flushed with triumph (the expression is hackneyed but accurate). Quite obviously, the castings had been carelessly handled at the other end. The treatment had been all wrong, and when a couple of the supposedly defective castings were tried out, after having been correctly treated, they gave splendid results.

The foundry manager reported with satisfaction. The salesman parked a couple of castings in his automobile, and went over to see the new buyer. He came away, leaving the castings and a good deal of his temper behind him. The new man refused to acknowledge his error, would not promise to try the castings, made certain pointed suggestions that there was no certainty these two castings belonged to the rejected lot, and showed by every word and look that for some mysterious reason he had taken a dislike to the firm from which his predecessor had purchased materials for so many years.

The Buyer Shows His Authority

Nevertheless, the salesman kept his temper outwardly, and reported to the sales manager. The sales manager was familiar with the problem of the new buyer. He knew that often a new man will reverse the procedure of the original buyer, simply to assert his own authority. He treated the problem in this way, wrote polite letters, and finally, rather than lose a good customer, replaced the castings without further ado.

The respite was brief. Before long a further lot of material came back, with another complaint, and an indication from the buyer that in future the castings would be obtained elsewhere. More correspondence passed on the conciliatory principle. The salesman called—did his best—but the result was nil.

There was no doubt whatever that the castings were perfectly sound. The salesman was prepared to go into the customer's works himself, choose a casting (*Please turn to page* 48)

Design Factors for Malleable Iron

Various considerations indicate ultimate economy in applying fundamental principles

By J. H. LANSING
Allith-Prouty Co., Danville, Ill.

MALLEABLE iron in its uses has kept pace with developments of transportation, first serving for harness and wagon parts, next becoming an important material of railway car construction and now hundreds of thousands of tons are used annually by the automotive industry. It also has played an important part in the development of agricultural machinery and of other machines and tools. Certain fundamental and established facts which are of importance when considering the outstanding properties of malleable iron will be listed briefly as follows:

Lists Characteristics of Malleable

1. Structural composition of the original hard iron castings consists of pearlite and cementite.
2. Primary graphite, that defect which was the cause of low physical characteristics of the product some years ago, now rarely is present, due to a better adjustment of carbon and silicon content, particularly the former, at a sufficiently low point to make certain that the carbon content will be wholly in the combined state.
3. Castings are poured at a temperature permitting sharp definition and an excellent surface, as well as affording freedom from occluded gases, thereby insuring soundness.
4. White iron castings obviously are coarse grained, hard and brittle, and as a necessary subsequent part of manufacture they are subjected to a heat treatment or conversion process whereby the original characteristics are rendered exceedingly strong, tough and ductile.
5. Structural composition of the annealed castings is made up of a matrix of ferrite throughout which nodules of free carbon, known as temper carbon, are distributed uniformly.
6. As indicated the finished product is tough, ductile, highly shock resistant, and due to the temperature at which the conversion process is carried through and, as a result of the slow cooling from that temperature, the castings are fine grained and free from internal strains.
7. These inherent properties provide ease of machining.
8. Due to the structure and freedom from strains, malleable iron castings have remarkable corrosive resistant and other properties.

Mechanical and physical properties of malleable castings are shown in Table I, taken from the "Symposium on Malleable Iron" presented at the joint meeting of the American Society for Testing Materials and the American Foundrymen's association, June, 1931.

As an example and illustrative of the increasing use of higher strength malleable iron, attention is called to the test results on a 2600-ton (57,000-piece) order of side stakes for railway gondola cars. This order was placed on the basis that standard test bars representing each heat were to have a yield point of not less than 35,000 pounds per square inch, and an elongation of not less than 18 per cent in 2 inches. The records of the tests from all heats of four foundries supplying the material were summarized in the symposium, from records supplied by the Malleable Iron Research institute, as shown in Table II.

A further field in which high strength malleable iron has firmly established itself is that of heavy traffic guard rails for large bridges. The greater part of malleable iron bridge guard rail work has been made to the following minimum requirements: Ultimate strength of 55,000 pounds per square inch; yield point of 35,000 pounds per square inch, and an elongation of 18 per cent in 2 inches.

Tests Show High Strength

One foundry handling that class of work has run 910 consecutive heats with the following minimum results: Ultimate strength, 56,490 pounds per square inch; yield point, 37,210 pounds per square inch; and elongation in 2 inches, 22.6 per cent. Average results for the 910 heats were, ultimate strength, 58,344 pounds per square inch; yield point, 38,494 pounds per square inch; and elongation in 2 inches, 25.9 per cent.

Members of the Malleable Iron Research institute have for the past 20 years so constantly improved the quality and tensile properties of malleable castings that there has resulted an ever increasing sphere of usefulness. Starting with a specification of 2.5 per cent elongation,

and 42,000 pounds ultimate tensile strength in 1904, an increase to 7½ per cent and 45,000 pounds was made in 1919 and in 1930 the specification stood at 10 per cent elongation, 32,500 pounds yield point and 50,000 pounds ultimate strength. In this connection, it will be noted that the yield point of malleable iron is a remarkably high percentage of the ultimate strength.

In addition to the inherent qualities of strength, toughness, ductility, etc., attention is directed to the remarkable facility malleable castings may be machined with. Indicative of this highly desirable characteristic is the great use of these castings in the automotive industry. In many other fields, where machinability and remarkable ability to withstand shock are important factors, the consumption is increasing and advancing steadily.

Numerous tests have established conclusively that a machined malleable iron test bar is not of appreciably less strength and ductility than an *as cast* bar of equal diameter. This is mentioned in view of the once prevalent falacy that most of the strength of malleable iron was in the decarburized surface or *skin*, and that the metal core therefore was of considerably less strength.

Where various considerations indicate the ultimate economy or desirability of an intricate design, malleable iron lends itself in a remarkable manner to its being cast in any conceivable form without prohibitive expense. However, these properties, which permit great latitude in design, should not obscure the fact that, in the great majority of cases, considerable economy may be effected by recognizing certain factors that make for the most economical production of the finished part. The statement has been made that the price per pound of a casting is the true measure of designer-foundry correlation, but we believe a much more valuable criterion to be the total cost of the finished part. In some cases it is possible to eliminate certain machine operations by redesign or reduction of stock, and in other cases the addition of more adequate finish allowance eliminates rejections and results in a lower ultimate cost per part.

Factors worthy of review in considering the designing of malleable iron castings are as follows:

To avoid unnecessary expense and delay, tentative designs should be submitted to the malleable foundry for suggestions as to possible changes which, while not affecting utility, will aid in producing a better and less expensive casting.

Thickness of casting sections should be as near uniform as possible, avoiding abrupt changes in section. Where it is necessary to vary metal from light to heavy section, a gradual taper of the joint makes for greater economy in production and for greater strength. If this is impracticable, ribs of sufficient thickness to facilitate feeding may be placed on the light sec- (*Please turn to page* 37)

Table II

Tensile Properties of Higher Strength Malleable Iron

Tensile Strength, Pounds per Square Inch

Foundry	No. of Tests	Maximum	Minimum	Average	Standard Deviation
No. 1	55	65,000	56,000	58,888	1596
No. 2	63	59,560	53,000	57,040	1375
No. 3	89	61,710	55,110	57,689	1142
No. 4	29	61,400	51,380	56,830	2146
Average Tensile Strength				57,612	

Yield Point, Pounds per Square Inch

No. 1	55				
No. 2	63	39,830	35,930	38,269	859
No. 3	89	39,690	36,340	38,004	636
No. 4	29	40,646	35,210	37,509	1486
Average Yield Point				37,927	

Elongation in 2 inches, Per Cent

No. 1	55	27.0	18.0	22.25	2.26
No. 2	63	31.0	20.0	24.70	2.79
No. 3	89	28.0	21.0	25.17	1.34
No. 4	29	26.6	18.4	20.26	1.74
Average Elongation				23.10	

Tensile strength.....57,600 pounds per square inch
Yield point.....37,900 pounds per square inch
Elongation in 2 inches.....23 per cent per square inch

Table I

Average Properties Of Malleable Iron Castings

Chemical composition	Carbon, 1.00 to 2.00 per cent; silicon 0.60 to 1.10 per cent; phosphorus, under 0.20 per cent; sulphur, 0.06 to 0.15 per cent; manganese under 0.30 per cent.
Physical constants:	
Specific gravity	7.15 to 7.45.
Coefficient of thermal expansion	Varies with temperature; average value 0.000012 per degree Cent. (0.0000066 per degree Fahr.)
Specific heat	Varies with temperature; average value between 20 and 100 degrees Cent., 0.122 calories per gram per degree Cent.
Mechanical properties:	
Tensile strength	54,000 pounds per square inch.
Yield point in tension	36,000 pounds per square inch.
Elongation in 2 inches	18 per cent.
Reduction of area	On standard specimens ground cylindrical before annealing, 18 to 25 per cent.
Modulus of elasticity in tension	25,000,000 pounds per square inch.
Compressive strength	Ductility precludes failure under compression or transverse loading.
Transverse strength	
Ultimate shearing strength	48,000 pounds per square inch.
Yield point in shear	23,000 pounds per square inch.
Modulus of rupture in torsion	58,000 pounds per square inch.
Yield point in torsion	24,000 pounds per square inch.
Brinell hardness number	115; range, 100 to 140.
Charpy impact value	7.75 foot-pounds.
Izod impact value	One investigator 360 tests average 9.3 foot-pounds.
Wedge test of impact	27 blows of 70 foot-pounds.
Fatigue endurance limit	0.5 x tensile strength.
Effect of temperature	Tensile strength starts to decrease at 800 degrees Fahr. and carbon redissolves at 1400 degrees Fahr.
Electrical and Magnetic Properties:	
Resistivity	28 to 37 microhms per centimeter cube.

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, Charles Vickers.

Will Eliminate Warping By Annealing the Castings

We manufacture machine tool castings which are giving us considerable trouble from warping. The castings are all right in the rough. They are given a rough cut and finished, and then the finished castings lay around from a week to a month before being assembled. At that time the castings are found to be warped. We have tried taking a rough cut, placing the castings in a furnace, and running the temperature up to 1050 degrees Fahr. The castings were cooled in the furnace, but the results were not satisfactory as when the finishing cut was taken, and the castings allowed to lie around a week before assembling, they were not true. The castings include slides, tables, and chucks, and we would like to know how to overcome the warpage.

Warping indicates the presence of internal stresses which may be due to peculiarities in design, although they occasionally are caused by hard cores, etc. Improper use of ribs, abrupt changes from heavy to light sections, lack of adequate fillets and other factors cause unequal expansions and contractions during the solidification of the casting, and consequently unrelieved stresses. When the stresses are relieved partially by time or by the removal of metal in machining the castings warp. The amount of stress *bottled up* as it were, frequently is surprising, and often castings crack in the yard or in the machining operation. However, such stresses usually are relieved by annealing below the critical range. In the present case we suspect insufficient time was allowed. Best practice calls for *slow* heating up followed by *soaking* at least one hour for each inch of casting section. Then the casting is cooled *slowly*. A temperature of 900 degrees Fahr. usually is better for annealing than 1050 degrees.

Tuyere Openings Will Be Satisfactory for Cupola

I am about to rebuild a 42-inch cupola with six 4 x 12-inch openings in the shell. The tuyeres will flare away from these openings to form a continuous opening at the face of the lining. Will this arrangement work satisfactorily?

Six openings 4 x 12 inches in the shell will admit the air satisfactorily from a 14-inch diameter blast pipe connected to a blower capable of delivering approximately 3500 cubic feet of air per minute at 8 to 10 ounces pressure. With a higher blast pressure and greater volume the cupola might be pushed to a maximum melting capacity of 14,000 pounds per hour, but under ordinary conditions better results and more satisfactory castings will be produced with a fairly mild blast. If you are interested in securing comprehensive information on the construction and operation of the cupola we direct your attention to *Melting Iron in the Cupola* by J. E. Hurst which may be purchased through THE FOUNDRY.

Opinions on Chromium In Malleable Cast Iron Vary

Can you give us any information on the maximum amount of chromium in malleable pig iron which will allow it to be used without encountering trouble in the resultant castings? Are there any references to that subject in the literature?

Practical opinion varies greatly on the permissible maximum of chromium in malleable cast iron. A few hold that amounts of even less than 0.01 per cent have an effect on annealing. Others feel that the presence of 0.05 per cent or 0.07 per cent is required to be detectable, and that 0.10 per cent is not prohibitive. We believe that a commercial tolerance might be placed at from 0.06 to 0.07 per cent maximum. Most of the opinions expressed are not based on any real

knowledge. References to chromium in malleable cast iron may be found in the following issues of THE FOUNDRY: June 1, 1929, page 474; June 15, 1929, page 524; July, 1932, page 30, and October, 1932, page 43. Other references are "Influence of Various Elements on the Graphitization of Cast Iron" in Vol. IV, No. 4, College of Engineering, Kyoto university, Japan, and some of the bulletins published by Iowa State college.

Brass Marker Plates Do Not Have Smooth Surface

We are trying to produce brass marker plates such as are used in memorial cemeteries, but we are having trouble getting a perfect surface. It seems that when we get the smoothness desired the metal will cut into sand somewhere and spoil it. When we eliminate the cutting the plate is too rough. Can you tell us what method and sand to use in producing good smooth plates? Also information about finishing plates after they are cast?

Smooth casting may be obtained with No. 0 grade Albany sand. However, if they are not smooth enough try mixing one-half old and one-half new No. 1 Albany sand together. To every 20 parts of the mixed sand add 1 part flour. That combination usually gives smoother castings than No. 0 or No. 00 sand, and the metal will not cut into the sand. A green coloration can be obtained by applying a solution made as follows: Dissolve 10 parts of copper in 20 parts of nitric acid. Dilute the solution with 150 parts of vinegar, and then add 5 parts of sal-ammoniac. Dip the castings in the solution or paint it on, and then allow the castings to stand in the air for a few days until the green color develops. Oil them with linseed oil, giving a light coat. In a day or two the oil will dry so that they may be rubbed with a soft woolen rag bringing out the patina.

Steel Castings Have Indentations on Bottom Face

We have noticed that some of our chunky steel castings which are flat on the drag side sometimes have irregular indentations on the bottom surface. These indentations are perfectly clean and not due to scabbing. Our opinion is that the trouble results from the splashing of the metal as it enters the mold from the gate. Do you agree with that opinion, and is there a remedy for it?

We do not believe that the indentation on the bottom of the castings can be due to splashing of the metal as it enters the mold. It is not possible, especially in a chunky casting, that splashes would leave their prints on the bottom of the casting without a large proportion of them being picked up and found sticking in the casting. That probably would be true even of splashes which went down the gate of one mold while another mold closely adjacent to it was being filled.

It is difficult to form an opinion without seeing the casting, but there is a possibility that the indentations may be formed through the application of the silica wash so that lumps are left on the surface of the mold. Those lumps would form impressions or indentations in the casting surface, and cases like that have been observed.

Gives Information on Bronzes Suitable for Gears

We would appreciate any information that you may offer to us regarding the following: We have on order a contract for worm gears. We would like to have the formula and specifications, also elongation and tensile strain to the best known composition for this item. We want a metal that will be very hard and tough, yet easy to machine, and which will not chip the teeth of the gears while they are operated.

The standard gear bronze, known as Stone's English gear bronze, used by all the large gear makers, contains 87 per cent copper; 2 per cent of 15 per cent phosphor-copper, and 11 per cent tin. It is easy to machine when exactly the stated amount of phosphorus is added, but it is not as easy to machine as a red brass. If that is expected it will be necessary to add lead to the alloy, using 2 per cent deducted from the copper. It is impossible to get a hard tough alloy, that will be *easy to machine*. Hardness and toughness will have to be sacrificed to get easy machin-

This 2063-foot tower costing $3,000,000 may be erected adjoining the 1933 exposition grounds at Chicago

ability as you cannot have both.

Physical properties of the bronze mentioned are: Ultimate tensile strength, 35,000 to 40,000 pounds per square inch; yield point, 22,000 to 25,000 pounds per square inch; elongation, 6 to 10 per cent in 2 inches; reduction of area, 7 to 9 per cent; specific gravity at 20 degrees Cent., 8.2; brinell hardness under 500 kilogram load for 30 seconds, 80; patternmakers allowance for shrinkage 0.125-inch per foot; weight per cubic inch, 0.31-pounds; compression, elastic limit, 16,000 pounds per square inch.

Lining in Cupola Burns Out on One Side

We have a new lining of cupola blocks in our cupola and notice on the first heat that the blocks in the rear showed hardly any burning out, while the blocks in the front or practically directly over the taphole, showed a burning out of about 1-inch in depth. Have you any suggestions as to what may be causing our trouble? Whenever such a condition has been mentioned at the conventions, others when commenting on it, always brought up the fact that the cupola operator was poking in the peep holes on that particular side. However, this is not our trouble at all as we do not poke in the peep holes at all during the operation of the cupola.

Apparently, the tuyeres opposite the slag hole side of the cupola were closed off at some period during the heat through coke, pieces of iron, or slag, which increased the blast on the other tuyeres. When that does take place it is necessary to poke the tuyeres open. Usually it is not necessary to poke the tuyeres as they remain open. However, it does happen that a tuyere or two may become plugged, and in that case an inspection through the peep hole will apprise the observer of the condition. Poking the tuyers should be resorted only to when the tuyere opening stays black for a considerable length of time.

Weak Sand Breaks Before Wash of Metal

We are having trouble with the letters washing in tablet work. We employ Albany sand and have tried making a facing with core compound and flour. We also have sprayed them with molasses water and dried them, but still have trouble. Is there any special tablet sand or ingredient that can be mixed with the sand to remedy the difficulty?

Possibly in making your tablets you did not mix the facing sand correctly. It is suggested that you try the following method.

Get a fine grade of Albany sand and dry it at a gentle heat. Then mill it thoroughly in a dry tumbling barrel using pig iron or other heavy weights. After a time it will be milled as fine as flour. Take some old, but good molding sand which has been riddled through a fine screen, and mix one part of it with two parts of the milled sand. To the mixture add flour in the proportion of one part flour to 20 parts of the mixed sands.

Mix well together, riddle a few times, and temper with water. Then imbed red-hot pieces of pig iron in the sand until it is steaming. Sprinkle a little water over the top, and cover with about 2 inches of cold sand which was reserved previously. Pat the heap down with the shovel, sprinkle with water, and allow to stand overnight. In the morning it will be mellow and tough.

Such molding sand will not break before the wash of the metal. In making the molds, print back the pattern as has been described often, and then spray the impression with molasses water. Dry the mold with a torch until it is toasted a nice brown color. Pour the molds while they still are warm. As far as we know, there is no special tablet sand that can be mixed with molding sand, or any other ingredient that will eliminate your trouble.

Ornamental Brass Work Lacks Smoothness

We have an opportunity of supplying brass and gun metal castings for light ornamental and name plate work, but one of our clients is not altogether satisfied with the castings we supply. These are quite solid when machined or polished, but the skin of the casting is rough to the touch. We have tried various sands including Trent sands from England and Albany sand and various mixtures for facings, but get the best results from flour and plumbago mixed 50-50 for facings. The results are fair but not satisfactory. The materials used in the main are new ingot metal.

Either the Trent or the Albany sand is suitable for making fine brass castings although we prefer No. O Albany sand for such work. Instead of mixing flour with plumbago for a facing, it is believed that you will obtain better results by mixing the flour with molding sand to form a facing.

The following method is suggested for trial: Mold the patterns so that the letters or ornamentation is in the cope, and see that the patterns have enough draft *to lift* in the cope. Make the mold in the usual way, and then lift off the cope. Place the cope to one side so that the impression is up, and spray it carefully with molasses water. Then using a fairly fine bag, dust the impression with new, slightly burnt molding sand. After that dust with lycopodium or a good grade of parting compound. Return the cope to the pattern and butt-ram all over again. Rap carefully and lift off the cope again. Remove the pattern and dust the impressions twice with flour, blowing the excess off each time. Just before pouring, skin dry the mold until it is nicely toasted. Then close and pour immediately.

Another method is to spray the impression with molasses water; dust with beam dust taken from the foundry beams; return the cope; ram lightly; finish, and pour in the green state without skin drying.

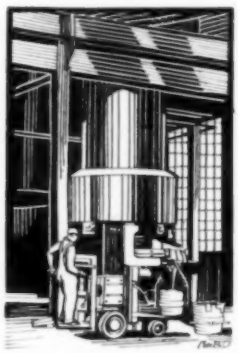
Warping of Lathe Beds Is Due to Strains

When lathe castings are taken from the foundry as soon as cast without undergoing any period of seasoning, is it possible to get one that will remain straight when machined only on the track side? Will that condition be improved if the castings are rough machined on top and bottom sides before finishing? Is that working condition amplified when a correspondingly higher percentage of scrap is used in the charges?

Unless the lathe casting has been molded with a bow or bend opposite to what it assumes when seasoned or aged, it will not be possible to get them straight unless the design is changed to eliminate the casting strains engendered. The expedient of making the casting with a reverse bow or camber has been utilized by experienced foundrymen, but usually only in cases where the casting bows or bends when cast in the normal way. The best way to eliminate the difficulty is to rough machine the casting and then normalize it at 900 degrees Fahr. for a sufficient length of time for the heat to penetrate all parts of the casting uniformly. Usually at least 1 hour for each inch in thickness of the heaviest section is allowed after the furnace reaches the desired temperature. The castings should be cooled slowly in the furnace. The slow cooling is essential otherwise the strains encountered will not be removed.

Since increase in scrap content of the metal charge usually increases the contraction of the resultant metal, bowing may be more severe when high quantities of scrap are employed, but that does not always hold true. We cannot say whether rough machining both sides will help, but doubt it. Sometimes the aging process is supposed to be speeded up by rough machining before aging. You can satisfy yourself on that point by trying it out.

Viewing Foundry Developments



At Short Range

A SWISS foundry melting six different mixtures from a 28-inch cupola determines the breaks by a chill test at the spout while the metal is tapped into the ladle. No errors are reported by users of the method.

♦ ♦ ♦

Air conditioning as a factor in human comfort is recognized. In fact, to go further some have prophesied that building of air conditioning equipment might prove the lid lifter of the current, or late, depression. But air conditioning in ovens baking cores is definitely on the horizon. Humidity in core ovens exercises a positive influence upon core properties. Proper control—air conditioning—may be the means of marked savings according to a core oil company that is conducting extensive experiments.

♦ ♦ ♦

A new orange juicer, constructed of aluminum castings and provided with a lever which applies the pressure to the orange, removes all of the juice from the fruit. Thus the orange becomes "good to the last drop."

♦ ♦ ♦

PRESSES of 100 to 750 tons capacity now are in use in pressing malleable castings to size and shape. Using specially-designed dies, these presses form and straighten the castings, often holding them within tolerances of 0.005 and 0.010 inch. Frequently the pressing takes the place of machining and eliminates large items of cost.

♦ ♦ ♦

In welding, when molten bronze is applied to a clean, fluxed surface heated to the proper temperature (a dull red heat) a thin layer of bronze will flow and spread out over the metal a little ahead of the main deposit. The flow will be free and natural like water spreading over a clean, damp surface, and will not have the appearance of water spreading out on a greasy surface. The edge of the molten bronze will not round out but will tend to spread out and flow freely over the heated metal.

♦ ♦ ♦

A company melting an aluminum alloy for die casting has found the average gas consumption required to melt down 320 pounds of cold metal in the cast iron pot and heat to a temperature of 1250 degrees Fahr. is 1770 cubic feet of 590 B.t.u. gas.

♦ ♦ ♦

Cast monel metal has the same strength range as annealed monel metal, but with a somewhat lower ductility. Strengths up to 100,000 pounds per square inch are obtained at the sacrifice of ductility.

♦ ♦ ♦

STEEL for high pressure castings for valves and fittings, and for miscellaneous railroad and jobbing work, is poured by one company into molds consisting of a mixture of 1000 pounds of No. 40 silica sand, 30 pounds of bentonite and 8 pounds of cereal binder. The average permeability for that facing was 232, with a variation for the monthly averages between 220 and 444. Average moisture was 2.6 per cent and the average green compressive strength was 4.9 pounds per square inch.

♦ ♦ ♦

Cupola metal for pouring large high test castings may be treated with as much as 30 pounds or more of fused soda ash with a reduction in sulphur to under 0.04 per cent in the finished casting.

♦ ♦ ♦

Assembly of cast-iron cylinder liners into the bores of an engine block is being facilitated by cooling the liners to a temperature of 109 degrees below zero with dry ice. Liners placed in a refrigerator for 16 minutes shrink 0.006 inch in diameter. They are placed in the bore immediately after being taken from the refrigerator and almost instantly exert a heavy pressure on the sides of the bore as they expand to their normal diameter.

♦ ♦ ♦

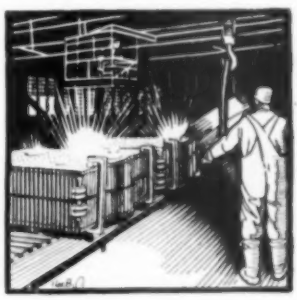
CHROMIUM plating on zinc die castings for durability under outdoor exposures requires an undercoating of at least 0.0003 inches of nickel. Evidence has shown that in practically every case of premature failure of chromium plate on zinc die casting sufficient nickel coating has not been applied.

♦ ♦ ♦

Although improper cleaning of metal prior to lacquering has a deleterious effect on all properties of a metal lacquer, the properties of resistance to stain spotting, adhesion and hardness are most noticeably affected. No clear metal lacquer of any type has yet been developed which will completely prevent the stain spotting on cast work unless the castings have been cleaned satisfactorily.

♦ ♦ ♦

Addition of small amounts of chromium (0.25 to 0.50 per cent) has been found to produce a definite improvement in the strength, deflection and density of the cast irons to



which the material was applied. Improvement in uniformity of hardness in varying sections, particularly with respect to the retention of hardness in heavy sections, also was noted.

♦ ♦ ♦

Addition of selenium to stainless steels of the 18 and 8 type produces a stainless steel having superior machining qualities.

The FOUNDRY Family Photograph Album

Upper Left
W. O. LARSON
W. O. Larson Foundry Co.,
Cleveland

Upper Right
R. D. PHELPS
Francis & Nygren Foundry Co.,
Chicago

Lower Left
C. P. WALKER
American Abrasive Metals Co.,
Irvington, N. J.

Lower Left
N. F. S. RUSSELL
U. S. Pipe & Foundry Co.,
Burlington, N. J.

Men of Industry

Whose Activities Are Making Foundry History

CLARENCE P. WALKER (see Family Album, opposite page) has been appointed plant manager for the American Abrasive Metals Co., Irvington, N. J., manufacturer of cast safety treads. He had been associated with the company about a year. Mr. Walker has been connected with the foundry since 1900, when he took up his apprenticeship at Hamilton, O. Later he went to Milwaukee where he worked for the Vilter Mfg. Co., Filer & Stowell Co., and Allis Chalmers Co. In 1916 he was appointed foundry superintendent for the Hardie-Tynes Co., Birmingham, Ala., where he remained until 1920 when he became general foreman for Joubert & Goslin Machine & Foundry Co., also of Birmingham. Ten years later he resigned to establish himself as a consultant in foundry practice, later to become affiliated with American Abrasive Metals Co. Mr. Walker received his early education in Ohio, later taking a course in engineering and metallurgy at the University of Wisconsin. He also received a diploma from the University of Alabama, Tuscaloosa, Ala., as a vocational teacher (under the Smith Hughes act).

A. D. LYNCH, director of personnel, Ohio Brass Co, Mansfield, O, was included in a list of 14 executives of industrial organizations who were honored recently by the Cleanliness institute, New York, for work in furthering industrial cleanliness among their own employes.

A. M. SNODGRASS has been appointed production manager of the Pittsfield, Mass. works of the General Electric Co. Mr. Snodgrass has been in the employ of that company for 20 years and since 1930 has been production manager of the West Lynn, Mass. works of the company.

WALTER O. LARSON, (see the Family Album, opposite page) for the past four years foundry manager, Hill Clutch Machine & Foundry Co., Cleveland, has resigned to become president of the W. O. Larson Foundry Co., with plant at Grafton, O. Previous to his connection with the Hill Clutch company. Mr. Larson was general manager of the Cuyahoga Foundry Co., Cleveland and before that was connected with the American Range & Foundry Co., Cleveland.

MERRILL G. BAKER, formerly vice president, Vanadium Corp. of America, New York, and recently asistant to the vice president, Ford, Bacon & Davis Inc., New York, has been elected president of the Union Steel Casting Co., Pittsburgh.

JAN R. DUNSFORD has been elected chairman of the board of the Union Steel Casting Co.

WALLACE G. SMITH, vice president and sales manager, Cramp Brass & Iron Foundries Co., Philadelphia, has resigned to become sales manager, specialty section, Baldwin Locomotive Works, Eddystone, Pa. JAMES J. NELSON has been made vice president and sales manager of the Cramp Brass & Iron Foundries Co. succeeding Mr. Smith.

SCHUYLER MERRITT, for the past eight years chairman of the board, Yale & Towne Mfg. Co., Stamford, Conn., has resigned, following his election to the house of representatives at Washington.

WALTER C. ALLEN, president of the company for 17 years, succeeds Mr. Merritt as chairman. W. GIBSON CAREY JR., vice president and treasurer, now is president, also remaining treasurer.

DR. HARRY P. EVANS has resigned his position as chief metallurgist, Firestone Steel Products, Akron, O. Mr. Evans was graduated from the University of Kansas, Lawrence, Kans., and received the degree of Doctor of Philosophy and Physical Chemistry and Physical Metallurgy from Iowa State College, Ames, Iowa, in 1925. He then served as metallurgist for the American Smelting & Refining Co. and as professor of chemistry and metallurgy at the Kansas State Teachers college and Iowa State college. From 1925 to 1930 he was metallurgical engineer, Pettibone Mulliken Co., Chicago, and from 1930 to 1931 was metallurgical engineer, Hubbard Steel Foundry Co., East Chicago, Ind. Mr. Evans has contributed several articles to the technical press on research in ferrous metallurgy and allied subjects.

HENRY D. SHARPE, president and treasurer, Brown & Sharpe Mfg. Co., Providence, R. I., recently was elected president of the New England Council.

W. J. GIBNEY, formerly vice president, Chemumg Foundry Co., Elmira, N. Y., has been made president of the recently formed Horseheads Foundry Co., Horseheads, N. Y.

CHARLES I. HODGSON, superintendent, Batavia, N. Y. plant of the Doehler Die Casting Co. has been transferred to Toledo where he will engage in sales development work for that company.

M. G. VENIER has been made foundry superintendent of the A. E. White Machine Works, Eau Claire, Wis. Mr. Venier's foundry experience began in 1913 when he was employed in a radiator shop. From 1916-1920 he was connected with the McDougall Duluth Shipbuilding Co., Duluth. For the next 8 years he served as foundry foreman of the Minnesota Radiator Co., Duluth, and then was appointed general plant superintendent of that company, serving in that capacity for 3 years. Mr. Venier is a graduate of McLain's System Inc.

C. E. PIPER, formerly assistant production manager, Erie works, General Electric Co., and for the past 4 years production manager of the Pittsfield, Mass. works of that company, has resigned and purchased an interest in Erie Bronze Co., Nineteenth and Chestnut streets, Erie, Pa. Mr. Piper started his service of 29 years with the General Electric Co., in 1903 at the Schenectady works. He began in the cost department

and remained at Schenectady until 1911 when he was transferred to the Erie works to install the cost system. He remained in charge of that work until 1921 when he entered the production department as assistant production manager. In 1928 he was transfered to the Pittsfield works to succeed F. R. Whittlesey, retired.

D. B. Patterson, sales manager Harnischfeger Corp., Milwaukee, has been elected vice president of the company. The position has been vacant since Walter Harnischfeger became president upon the death of his father, Henry Harnischfeger.

Arthur W. Coppin has been elected secretary to succeed Louis Quarles, resigned. W. F. Heilman succeeds Mr. Coppin as assistant secretary.

James V. Reich, formerly foundry superintendent, Texas Electric Steel Castings Co., Houston, Texas, has been made metallurgist, Welland Electric Steel Castings Co., Welland, Ontario. Mr. Reich started in the foundry business at the age of 17 as laboratory assistant at the Ohio Steel Foundry Co., Bucyrus, O. Later he was transferred to the Springfield, O. plant as electric furnace helper and then was placed in charge of melting. In 1924 he became connected with the Oklahoma Steel Casting Co., Tulsa, Okla., as melter and a year later he was made melter of the Crucible Steel Casting Co., Lansdowne, Pa. In that connection he also was engaged in research work for George Batty, Steel Casting Development bureau, Philadelphia. In 1928 he became connected with the Detroit Steel Castings Co., Detroit, as melter and assistant foundry foreman and 8 months later was promoted to superintendent of melting, in charge of open-hearth and electric furnaces.

Alloy Cast Iron Discussed at Milwaukee

E. K. Smith, metallurgist, Electro Metallurgical Sales Corp., Chicago, addressed the regular meeting of the Wisconsin Gray Iron Foundry group on Dec. 21 on the subject "Application of Alloyed Cast Iron." Mr. Smith discussed the use of alloy cast iron in a large variety of castings requiring special properties to meet unusual service and conditions. The talk was illustrated with a group of excellent slides.

In a general discussion following Gottfried Olson, Illinois Malleable Iron Co., Chicago, discussed the melting of various types of alloys in a small 21-inch cupola. That melting unit was described in the October issue of The Foundry on Page 17.

Birmingham Groups Arrange Joint Meeting

Foundry practice is to be discussed at a meeting of designers and producers of castings to be held Feb. 13 and 14 at Birmingham, under the sponsorship of the Birmingham section of the American Society of Mechanical Engineers, with the American Foundrymen's association and local foundrymen co-operating.

Similar joint district meetings between foundrymen and engineers were held in several cities during the early months of 1932, with castings design the principal topic of discussion. Technical sessions of the Birmingham meeting will stress recent developments made in cast metals and foundry equipment from the point of view of the engineer. Plant visits will be a feature of the gathering, the Birmingham district containing an unusual number of exceptionally interesting industrial plants.

Arrangements for the February meeting are being prepared under the direction of a special committee of local engineers and foundrymen headed by John M. Gilfillan. The chairman on the Birmingham section is S. D. Moxley, chief engineer, American Cast Iron Pipe Co., Birmingham.

Tentative program for the two day meeting is as follows:

Monday, Feb. 13,

9:00 a.m.—Registration, Tutwiler hotel
2:00 p.m.—Plant visitation
6:00 p.m.—Open house

Tuesday Feb. 14

9:00 a.m.—Plant visitation
12:00 noon—Luncheon talk
2:00 p.m.—Plant visitation
4:00 p.m.—Technical session
6:15 p.m.—Dinner
8:00 p.m.—Evening meeting

Those attending the foundry meeting held in Birmingham in January, 1931, will recall the well arranged and interesting program provided at that time. Anyone interested in the subject, either from the designing or construction angle, is invited to attend.

Symposium Covers Data on Steel Castings

Carbon steel and alloy steel castings are covered in considerable detail in a recent joint publication of the American Foundrymen's association and the American Society for Testing Materials, entitled "Symposium on Steel Castings." The chief purpose of the publication is to provide the engineering profession with authoritative information on the properties of steel castings.

The first two papers give, respectively, a general survey of the industry and statistical data on steel castings production in the United States. Then follows a contribution on the design of steel castings, which emphasizes the importance of co-operation between designer and founder and discusses extensively, contraction and crystallization phenomena under such headings as crystal formation, feeding of sections, effect of heat transmission, deep pockets, linear shrinkage, etc.

A paper entitled "Purchase Requirements for Steel Castings with Notes on Physical Properties in Test Bars and in Commercial Castings" follows. This explains design factors influencing test specimen results, chemical limitations for carbon steel and summarizes the A. S. T. M. and other specifications for carbon-steel and alloy-steel castings. One of the most extensive papers gives physical and mechanical properties of some-well-known cast steels. This presents a comprehensive correlation from many sources, both domestic and foreign, of data on the more frequently ascertained physical properties.

Representative properties of cast medium pearlitic steels are reviewed thoroughly. Involved are pearlitic carbon and low-alloy steels, containing various percentages of molybdenum, vanadium, chromium and nickel, chromium steels for high temperatures, and pearlitic manganese steels.

A technical paper on "Castings of Corrosion-Resistant Steels" gives extensive data on the principal classes of these alloys, covering physical properties at room and elevated temperatures, machining and welding behavior, coefficient of thermal expansion, melting point, maximum temperature for safe use, etc. This contribution also includes a discussion of general considerations affecting alloy selection.

The "Symposium on Steel Castings" may be obtained, from the American Society for Testing Materials, 1315 Spruce street, Philadelphia, or the American Foundrymen's Association, 222 West Adams street, Chicago, for $1.00.

Refractory Paint

Laclede Christy Clay Products Co., St. Louis, manufacturer of fire brick, refractory cements, etc., is introducing a new high temperature paint, an odorless heat resisting, protective coating material for miscellaneous industrial applications. The most refractory type of this new line is the black paint which will withstand temperature of approximately 1800 degrees Fahr. Paint of other colors manufactured include red, green, gray and white and will withstand temperatures ranging from 1000 to 1400 degrees Fahrenheit.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE—*Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Proposes Classification As Yardstick of Values

TO THE EDITORS:

Yes, there is an answer to the question you ask on page 11 of your November issue:

"What about prices?"

"Would the variety of cast products permit any classification of value to the foundry industry?"

The foundry industry is probably hit as badly as any other by losses recurring month after month ever since the depression started. This is just as true of the malleable foundries as of any of the others.

Conditions throughout the foundry business, and practically all other lines of business, are mostly the result of a state of mind which first created the Anti-Trust Laws and subsequently keeps them alive on the statute books of the nation. So long as Congress remains in its present state of intellectual bankruptcy, which will probably be for many years to come, there is no hope in the shape of legislation for any improvement in the foundry or any other industry.

Customers receiving cash out of the drawer with every shipment of castings, certainly will not organize to help the foundry industry make itself profitable. Vendors to the foundry industry seem quite as willing to sell their raw material and services to the worst price-cutting concerns as to those who attempt to run on sound business principles, so that no hope may be obtained from a prayer that the vendors help the foundry industry organize itself.

The banks are all neighborhood concerns subject to local interests, views and influences rather than students of and advisors on a nationwide problem. Certainly they cannot be expected to find an answer to your questions.

The head of every foundry in the land, as well as every other business for that matter, can remember many years ago when his fond mother told him that he could be President some day. His loving aunts repeated and thoughtless schoolteachers held out the same bait. Very few Americans have every outgrown that foolish notion and on every hand we see the daily example of the "great American business men" who could be better mayors, governors, senators, congressmen, presidents, or ambassadors than anyone who holds such offices.

Possibly enough more years of depression will take that conceit out of a few and replace our cocksureness with humility and willingness to learn. About the first thing which might follow such a change would be a realization of the necessity for cooperating in the adoption of sane business practices, principles, rules and standards. Probably the very first of such rules would be the use of a rigid, uniform yardstick for classifying jobs, estimating costs and establishing prices for foundry products.

There are a few very simple principles which seem obvious but have lost all influence on the thinking of foundry executives in their desperate effort to secure someone's else business. It hardly can be questioned or disputed that—

1. Light weight castings cost more per pound than heavy ones.
2. As the weight per mold grows less, the cost goes up.
3. Cored castings cost more than plain castings.
4. Small quantities cost more than large quantities.
5. Any quantity can be made more cheaply and better from modern, proper metal or wood pattern equipment than from old-fashioned, loose, ungated, short-lived and misshapen patterns, which frequently cost more for upkeep or repairs than any single order for castings is worth.

With these five points as a basis, the malleable industry built up a "Classification of Castings" back during the days of the war at the suggestion of the war industries board and federal government. This malleable classification gave the above items reasonable and fair values according to the conditions then existing. Necessarily that classification or any other has to adopt some arbitrary standards and divisions just as real estate has to be definitely set off and marked by boundaries. Prior to that classification there had been nothing in the shape of a yardstick available for use by any one foundry or for any two successive jobs, days or years.

That classification therefore became a yardstick which had in it every element of fairness and adjustment to the variations in weight of castings, weight per mold, quantities, etc. While the classification was necessarily arbitrary and could doubtless be improved upon, no one has yet prepared any other substitute classification which offers any improvement of importance over the one devised under pressure of Wartime, governmental authority.

The prices which were set up for each of the various classifications back during the War period might be entirely out of scale for present conditions but the classification itself was built on sound principles and deserves to be perpetuated, not only for the malleable industry but as suggesting the basic principles for use in classification of gray iron, steel, bronze and aluminum castings. In the study and work of producing the classification at that time, over three thousand (3000) separate individual costs collected from fourteen or fifteen individual plants provided the statistical data for both the classification and the prices then suggested. Since the war the Malleable Iron Research institute has on different occasions collected and tabulated thousands of individual costs which have each time confirmed the original basic classification as a fair one for every manufacturer and user of malleable castings.

Similar studies in the gray iron, steel, bronze and aluminum fields should enable those branches of the foundry industry to develop similar classifications and should be of immense benefit in providing each branch of the foundry industry with a yardstick which could thereafter be used just as all present standards or units are used for measuring lands, liquids, materials of all kinds, distances, temperatures, time and even profits and losses.

MALLEABLE MANUFACTURER.

Question Unanswered

TO THE EDITORS:

Last May at the American Foundrymen's association meeting in Detroit, I had the very great privilege of hearing Mr. Judson give his talk on "High Test Iron for Pressure Castings." This was the only paper given without reference to notes of any kind and was by far the most convincing of any I have heard. At that time Mr. Judson put the following question squarely before those present, and this question went unanswered, to be asked again in THE FOUNDRY, November, 1932. "What is there about this iron that makes it nonshrinking, insofar as shrinkage troubles in the foundry are concerned?"

At the time this question was asked well known authorities on gray iron

were present, but not a single one offered an answer to this question. It scarcely seems possible that no one in this country who reads THE FOUNDRY can answer this question.

In our own work which deals with castings of up to 24 inches in cross section we have had little shrinkage with one cupola iron containing as high as 96 per cent steel scrap (the remaining 4 per cent being alloys) but we have been forced to use large risers with medium sized wedge gates.

We feel, although we are using alloys, that our iron is similar to that Mr. Judson is making, but are at a loss to account for the lack of shrinkage. If anyone is able to offer an explanation to Mr. Judson's question, I hope you will print it in an early issue of THE FOUNDRY.

HENRY C. GRIGGS.
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Concise History

TO THE EDITORS:

Just a line to extend my thanks for the interesting matter contained in the December issue of THE FOUNDRY.

The article "Through the Years with THE FOUNDRY" proved especially interesting. It contains a very concise history of your magazine, bringing forth all the various developments in a short and throrough manner.

Many of the other articles are also very interesting, but the one referred to appealed to me particularly.

FREDERICK H. LANDOLT
Penn Brass & Bronze Works, Brooklyn, N. Y.

Pittsburgh Group Holds Christmas Party

The thirty-sixth annual dinner and Christmas party of the Pittsburgh Foundrymen's association was held at Ft. Pitt hotel Dec. 19. A large turnout of members and friends was recorded and 180 peopled were served at the dinner. Twenty-five acts of vaudeville and an orchestra were included in the evening's entertainment.

The regular meeting to be held at Fr. Pitt hotel on Jan. 16 will be addressed by J. G. Ritter, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. on "Shall It Be Cast or Welded." The February meeting will be addressed by M. G. Sternberg, general manager in charge of operations for the Continental Roll & Steel Foundry Co.

The Federal Specifications board recently has proposed a revision to the federal specification for ferrosilicon.

Railroad Tries New Type Driving Wheel

Successful completion of tests of a new type of driving wheel for locomotives was announced recently by the New York Central. General adoption of the new wheel which is manufactured by the Scullin Steel Co. St. Louis, will change the appearance of American locomotives materially.

The new type of wheel consists of double disk centers over which is placed an ordinary locomotive tire as shown in the accompanying illustration. In the conventional design of spoke-type of driving wheel center with integral cast counterbalance block, uneven cooling of the material with its varying sized sections makes the casting difficult. The new type of wheel is said to permit of a markedly superior casting design.

The new wheel centers have been tested on New York Central locomotive No. 2726, now in regular service between Albany and Syracuse. It is the first locomotive to be fully equipped with the new wheel centers. Pockets for obtaining necessary counterbalance weights are cast in the wheel as a part of the two-plate supporting structure and these cavities are filled with lead. Holes in the wheel centers permit ready access to pins behind them.

The standard design of spoke type wheel center for locomotive No. 2726 weighed 22,440 pounds for the eight wheels. After counterbalance cavities had been filled with lead the new wheel centers weighed 20,406 pounds, a net saving of approximately 2000 pounds. Included in the lead weight was 866 pounds added for cross counterbalancing.

The new wheel center castings alone, excluding the lead, weighed 14,890 pounds, a reduction of 7200 pounds in steel casting weight over the usual spoke type wheel center. The reduction in weight will lessen considerably the impact of the wheels on the rails, thus tending to lengthen their life and reduce maintenance costs.

It is expected that other New York Central locomotives will be similarly equipped when they are sent to the shops for repairs.

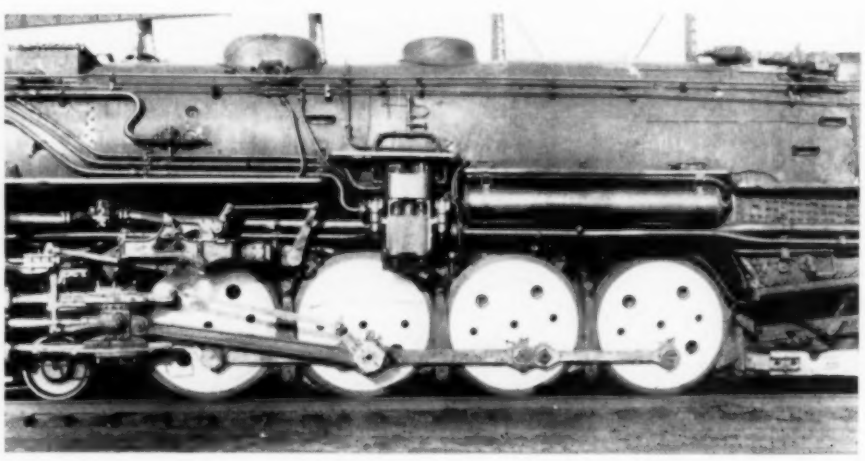
Book Review

Riches For All, by Harrison E. Fryberger, cloth, 138 pages 5x7½ inches, published by the Advance Publishing Co., and supplied by THE FOUNDRY, Cleveland, for $1.00 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

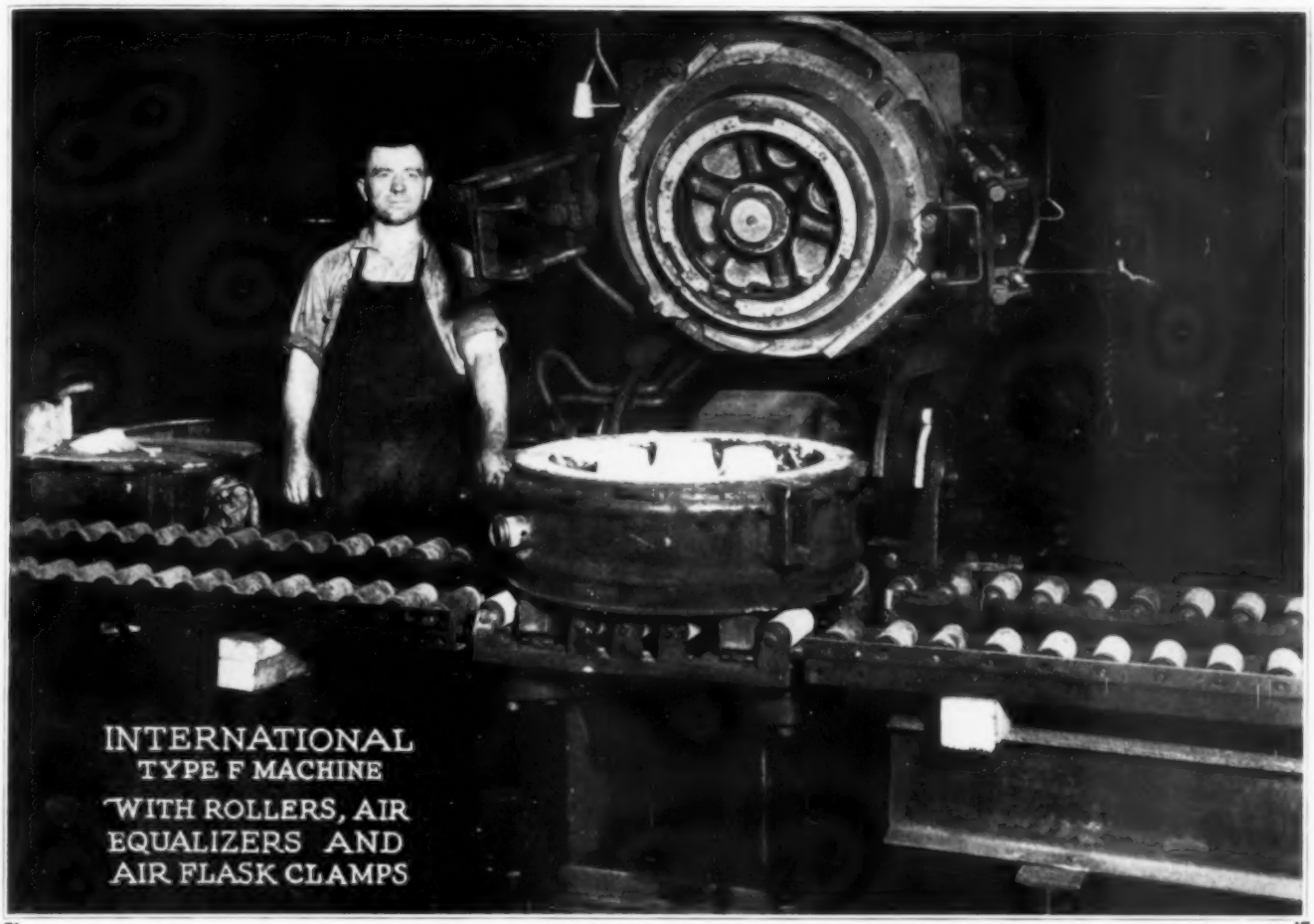
This is a companion book to *The Abolition of Poverty*, by the same author and represents a continuation of the discussion undertaken in the previous volume. The author attributes the present business depression to the fact that the masses of people have no money with which to buy and then undertakes to discuss in more or less detail 12 national economic abuses responsible for the unequal distribution of wealth.

The ills are represented by the unlimited inheritance of unearned wealth, the chain store, criminal stock speculation, corporate abuses, excesses practiced by banks, the exploitation of the South and West, unjust taxation, public graft, the foisting of worthless securities upon American investors, delay in making a decision regarding cancellation of war debts, the fluctuation of the purchasing power of the dollar and the concentration of wealth in the hands of a few.

Being a lawyer, the author naturally looks to our law making bodies in providing methods for the return of prosperity. The reader believing that too many laws may be responsible in a measure for some of our present difficulties, probably will not be convinced that legislation will achieve the goal outlined in this book.



The new type of disk wheel recently tested by the New York Central, will change the appearance of locomotives



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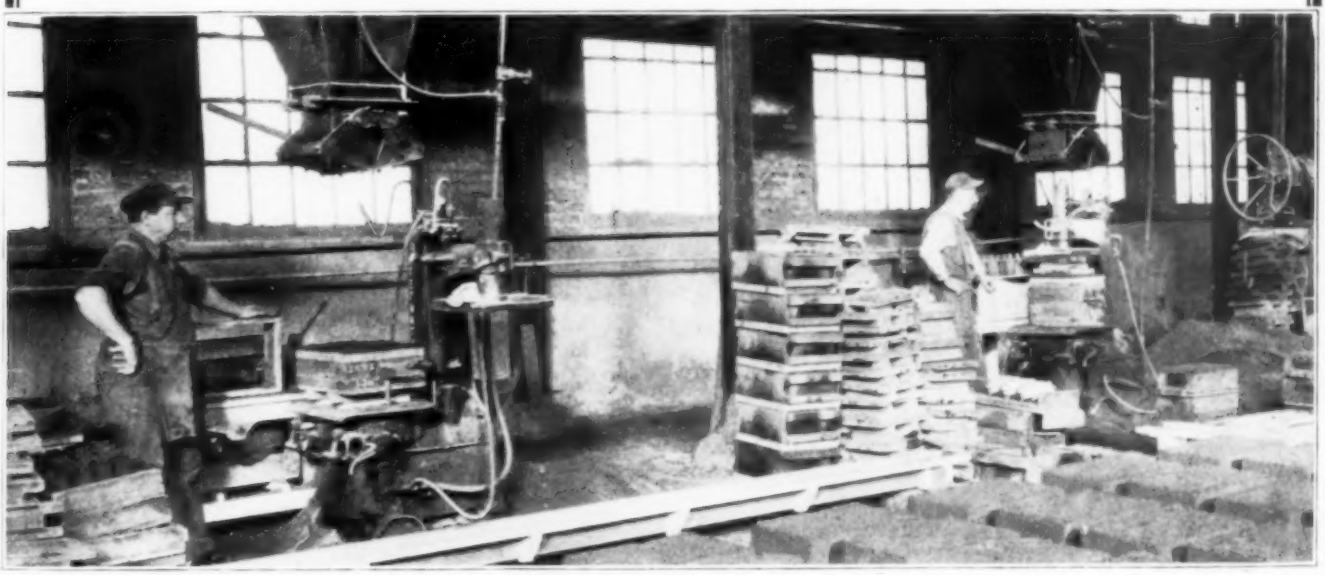

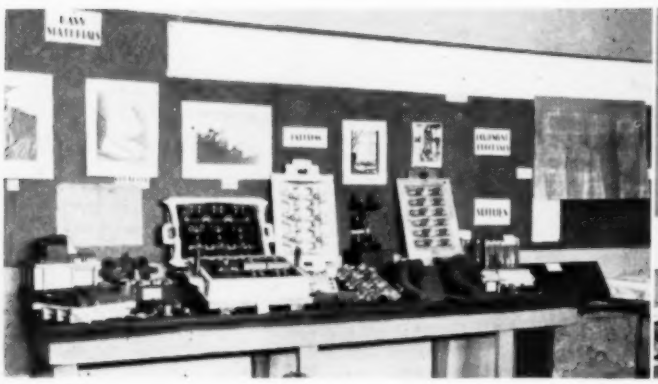

Fig. 1—The first part of the display showed raw materials, patterns, equipment and supplies. Fig. 2—Examples pointed to changes in design to increase utility

Displays Malleable Castings

Lake City Malleable Co. stages interesting exhibit of products in downtown Cleveland

THE Lake City Malleable Co., Cleveland, maintained an elaborate display in the Hanna building from Dec. 7 to Dec. 30, showing the evolution of a casting from the raw materials to the finished product. In addition to the educational feature, the exhibit catered to the active latent artistic taste of the customers, designers, engineers, salesmen, architects and general public who viewed the various objects on display.

Men familiar with the routine production of malleable castings admired the manner in which the sequence of operation was staged, the excellence of detail and the beauty of the finished castings. Customers were impressed with the efforts of the foundryman to meet their requirements. Technical men particularly were interested in the methods for selecting the raw materials and for controlling the processes in the various stages. In several instances pairs of castings were grouped to show the original design and the improved design worked out in the foundry resulting in improved appearance, greater uniformity of metal thickness and reduction in total weight. In other instances assemblies subject to corrosion were displayed to illustrate the remarkable corrosion resistance of malleable iron.

Commencing at one side and extending around the four sides of the room the exhibit included samples of metals and fuel, sand, patterns and coreboxes, obsolete and improved

Fig. 3—Many interesting uses of malleable castings were illustrated. Fig. 4—Another section showed the advertising material of the company and displayed methods of gating, etc.

methods of mounting patterns for rapid and economical production, annealing packing and methods, testing apparatus, chart showing amount of material handled per ton of castings, examples of change in design of castings, variety of devices made wholly or in part of malleable iron, common defects in castings and methods of preventing these defects, test bars and records, castings hammered and bent out of shape to illustrate malleability, method of applying gates and risers to insure perfect castings free from shrinkage, segregation, cracks and distortion. The entire display constitutes a striking evidence of the high plane of excellence in craftsmanship and technology attained in the malleable industry.

Design Factors for Malleable Iron

(*Concluded from page* 25)

tions so as to connect with and feed into a heavy section or boss.

Where heavy sections such as bosses or lugs are located on the interior, it is desirable to have heavy sections of metal leading to feeding source.

Location and size of the ribs should be such that they can be fed, or, if connecting light and heavy sections, they should be of such thickness that they can be used to feed metal through into the heavy parts.

A suitable place should be provided to attach gates and feeders to heavy sections.

Use as large fillets as possible and avoid the use of re-entrant angles. The reason for rounded corners and large fillets are: (1) easier molding; (2) less foundry scrap from shrinkage and cracks; and (3) less danger of cutting away of sand by flowing iron.

Where possible, avoid use of dry sand cores to eliminate coremaking expense and to produce a cleaner casting.

Use ram-up cores in preference to set cores where practicable.

Parting lines should be as near even as possible.

Designs should provide ample draft for easy molding.

Try to avoid all deep pockets and small recesses that would complicate drawing the pattern or lifting the cope.

Sufficient finish allowance should be given when castings are to be machined, and the amount of such finish should be indicated. For small parts from 1/32 to 1/16 inch finish is satisfactory with larger parts requiring a proportionately greater allowance. In determining the necessary amount of finish, factors to be considered are as follows: Size of casting; Whether a heavy sectioned compact casting or a large light sectioned casting, the latter having, of course, greater tendency to warp; Whether part is to be made in sufficiently large production quantities to justify the making of straightening dies; many finishing operations on malleable castings can be performed in a coining press which practically eliminates finish allowance in the case of these particular operations; many disk grinding operations are performed on malleable castings, for which operations but a few thousandths finish is required.

Locating points should be held to one side of the parting to eliminate trouble in machining.

When castings are to be machined, blueprints sent to the patternmaker always should show machine shop locating points. If these are not shown the patternmaker either will not consider these points or may assume them to be other than those which will be used in machining the part.

For economical production, due principally to some warpage, dimensions of castings should not be held to closer tolerance limits than is necessary.

If there is an opportunity to choose between a single large lightweight cored or intricate casting and an assembly of two or more smaller ones, the latter is preferable.

In Many Fields

PROGRESS in the manufacture of a high quality malleable iron has resulted in the application of castings of that material to a wide variety of uses in many fields of activity. In practically every instance, certain fundamental principles applied to the design of the malleable casting will result in a product well fitted to meet the ever increasing demands experienced in service. Points to be considered in the design of malleable castings are outlined in this article, which is abstracted from a paper presented at a joint meeting of the Chicago section of the American Society of Mechanical Engineers, Western Society of Engineers, Chicago Foundrymen's association and the Chicago Foundrymen's club. The author is works manager, Danville Malleable Iron Division, Allith-Prouty Co., Danville, Ill.

Foundrymen Form Association at Rockford

Rock River Valley Foundrymen's association recently was organized by foundrymen in Rockford, Ill. The following officers have been elected: President, C. M. Dale, Liberty Foundry Co., Rockford; vice president, E. J. Mohr, Gunite Foundry Corp., Rockford; secretary-treasurer, G. J. Landstrom, Sundstrand Machine Tool Co., Rockford. Directors were elected as follows: Allen Mattison, Mattison Machine Works, Rockford; J. Westwick, J. Westwick & Sons, Galena; R. E. Wickwire, National Sewing Machine Co., Belvidere; V. Firestone, Arcade Mfg. Co., Freeport; D. P. Forbes, Gunite Foundries Corp., Rockford; H. J. Jilbert, Geo. D. Roper Corp., Rockford; H. Benethum, Stover Engine Works, Freeport; W. H. Volkmar, J. I. Case Co., Rockford; H. Wahlen, Bolt Iron Works, Beloit, Wis.

The second meeting of the group was held on Dec. 20 with Major R. A. Bull, director, Electric Steel Founders' Research group, Chicago, as speaker.

Book Review

Gmelin's Handbook of Inorganic Chemistry (Gmelins Handbuch der anorganischen Chemie), edited by the Deutschen Chemischen Gesellschaft, paper, 294 pages, 7 x 10 inches, published by Chemie G.m.b.H., Berlin Germany, and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

This volume printed in German is section 5 of part B of the series relating to iron that form a part of Gmelin's handbook. It continues the information on iron compounds giving those with 31 other metallic elements. The divisions are iron with lithium, sodium, potassium, ammonium, rubidium, caesium, beryllium, magnesium, calcium, strontium, barium, zinc, cadmium, aluminum, and gallium. Other iron combinations are those with indium, thallium, titanium, zirconium, thorium, tin, lead, vanadium, niobium, chromium, molybdenum, tungsten, uranium, manganese, nickel and cobalt.

Alloy Castings

"The Brackelsberg Furnace and the Production of Alloy Castings" was discussed by Don Reese, metallurgist, Whiting Corp., Harvey, Ill., at the regular meeting of the New Jersey Foundrymen's association held at Newark on Thursday evening, Dec. 13.

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

CRACKS in trolley wheel castings may be due to one of several causes including faulty design, defective metal and style of gate. Occasionally two of these factors may be present and in comparatively rare instances all three may be responsible for the defective castings. Usually an experienced man can determine the cause of the trouble readily and apply the proper remedy. However even a comparatively inexperienced man can solve the problem by conducting a few experiments and carefully noting the results.

Marked difference in metal section between the hub, the web and the rim may cause a crack even where the metal composition, melting and pouring conditions are suitable and where the gates are designed properly. In this connection it is pertinent to point out that a properly designed pattern may yield a defective casting through careless molding and coremaking practice. This is praticularly true where dry sand cores are employed.

In some instances the cores sag or shrink during the drying process and consequently do not properly fill the space in the mold. Naturally, since the core rests on the bottom print, the discrepancy in metal thickness appears on the upper side of the core. The fin on the upper edge also may cause a crack in the rim.

Prepare the Rings

Sawing the casting through the center or checking the thickness accurately with a pair of calipers will furnish the foundryman with a clue on which to base further investigation. In the majority of instances green sand cores are employed in making trolley wheel castings. A little initial expense is involved in the preparation of the flanged rings in which the cores are formed, but this is quickly absorbed where the castings are made in any considerable quantity. Also, by adjusting the core prints on several patterns within a definite range of sizes, one set of core rings will serve. This item naturally will appeal more to men who work on short orders, than to men producing immense quantities of duplicate castings.

Where the design of the casting definitely is at fault, and the defective casting is not due to faulty melting or molding practice, co-operation of the customer should be enlisted in modifying the design. In the interest of both customer and foundryman, this detail should be settled in the beginning, but this is not always possible.

The second cause, defective metal, does not necessarily mean metal originally sound, but rendered defective in the melting process. Improperly melted metal will produce defective castings, but in the majority of instances the cause of the trouble is self evident.

Reference to defective metal in this particular instance applies to occasional lots of virgin copper which cause cracked castings. Up to the present no satisfactory method has been discovered for utilizing this metal. Substitution of a different lot of copper is the only remedy. This feature will be taken up more in detail later in the presentation of several typical instances of all copper castings. Trolley wheel castings are poured from a mixture approximating copper 91 per cent, tin 7 per cent and zinc 2 per cent. Phosphorus to the extent of 0.25 per cent usually is introduced by adding a small piece of phosphor copper or phosphor tin to each pot of metal.

Local conditions, and these include habit and custom, usually determine the style of gate adopted in any given foundry engaged in the production of trolley wheel castings. In some shops the two or four molds in a flask are gated directly into the upper rim from a central sprue. In others, horn gates in the drag convey the metal to the hubs of the wheels.

Object to Horn Gates

While admitting that a horn gate is a highly desirable type to use on a trolley wheel, many foundrymen claim that it increases the amount of molten metal required and also slows down production. As with any other claim, this can be accepted or rejected with qualifications. If, for example, experience shows in certain instances that a horn gate is the only type of gate that produces satisfactory castings, manifestly the extra metal and the slowing down in production are factors which have no bearing. No intelligent person needs to be told that 100 molds yielding 100 perfect castings represents a better day's work than 150 molds from which the salable castings number only 100.

However, with good pattern rigging, it is an open question if the application of horn gates slows down production. Without doubt horn gates involve the use of more metal than small plain horizontal gates connecting the mold with the sprue at the cope and drag joint line of the mold. They compare favorably in this respect with other types of top and bottom gates some times employed in preference to the small gates at the joint.

Various types of bottom gates were described and illustrated in earlier numbers of this series. They are just as applicable to nonferrous as to ferrous castings. Attention is directed to the type of gate shown in Fig. 191 which may be applied to two, or for that matter any number of patterns within practical limita-

(*Continued on page* 40)

Wheels Crack

GATES occasionally may be responsible for cracks in the rim or the web of trolley wheel castings, but in the majority of instances this form of defect may be traced to other causes including the design of the casting, careless molding or coremaking methods or the character of the metal. Most of these castings are molded two or four in a flask and are gated from a central sprue into the rim. Alternative methods, advisable for adoption under special conditions include top and bottom gating on the hub, also a radically different method whereby the wheels are molded vertically, that is on edge, and poured in that position.

• FOREMOST

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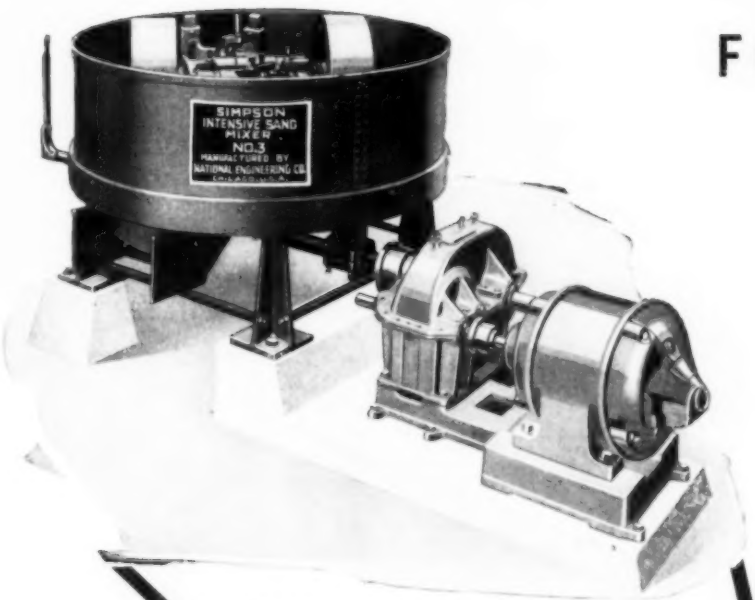

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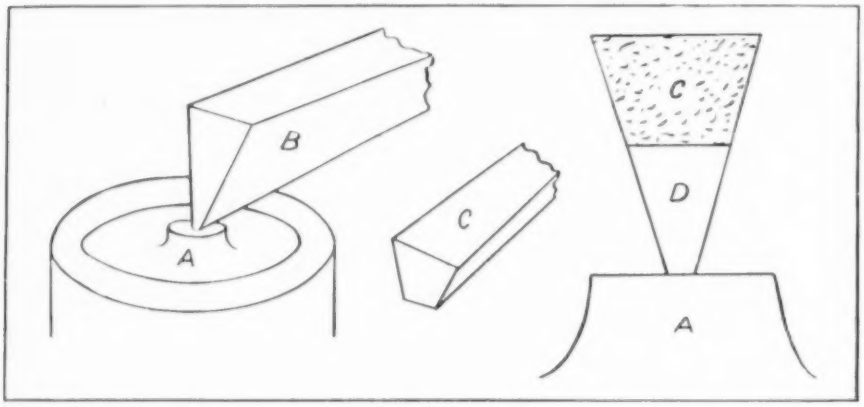

Fig. 191—Showing method of introducing metal through a gate in the bottom of the hub

(*Continued from page* 40)

tions in a flask. Trolley wheels, according to size, usually are made either two or four in a flask. A straight gate bar will serve two patterns, while an *X* design will serve four patterns. The sprue in each instance is connected to the center.

In practice the gate pattern *B* rests apex down on the trolley wheel patterns in the drag. When the drag is rammed full of sand and scraped off, the flat top of the gate pattern *B* is exposed. The molder lifts the pattern out of the sand and drops the dry sand core *C* into the cavity. This core occupies part of the space. The remainder of the space *D* is the gate or channel through which the metal is conveyed from a central vertical sprue to the hub cavity.

The core *C* is a little *full* for the print and therefore fits tightly when forced down by the bottom board on the drag. This tight fit provides an effectual seal against any metal leaking through to the bottom board during the pouring process.

Poured on Top

Certain conditions, exceedingly thin rims, wide, fragile green sand cores, force the foundryman to gate trolley wheels in the center, either on the top or the bottom. With two or four molds in a flask, the gates must be arranged to fill all mold cavities simultaneously. First because that is the most economical method and, second, if they are poured in succession, the gas will accumulate in the second, third and fourth mold cavity. This gas is explosive and will wreck the interior of the mold when lighted by the first drop of molten metal.

Top gating involves the use of an extra cope containing a central sprue and a channel leading from that sprue to each of the vertical sprues leading through the true cope to the hub of each wheel.

A variation from this procedure is shown in Fig. 192 where the cast iron cope weight is provided with a sprue opening in the center and a number of horizontal runner channels in the face which rests on the cope. These channels are well tapered to insure easy release of the bronze. In actual practice the weights are removed immediately after the metal solidifies and therefore no trouble is experienced.

A small flowoff at any of the four sides will show when the mold is filled and will prevent the metal from filling the tapered opening in the plate. Wherever possible—and this applies to practically any kind of a mold—the best method is to pour the metal from a ladle containing just the right amount. Practical operating conditions interfere with this method to a great extent, nevertheless practical foundrymen admit its merits.

Cut the Metal Short

Where standardized conditions enable the pourer to determine accurately the amount of metal poured, he can cut the stream short and thus prevent any residue of metal in the pouring head or in the channels in the cope weight.

Experienced men will not need to be cautioned, but unskilled or careless operators must be warned of the danger lurking in a wet or even a cold, damp plate. Molten metal will convert the moisture into steam and this steam when confined is highly explosive. The resulting explosion may scatter some of the molten metal and severely burn any person or persons in the vicinity.

With many trolley wheel castings a plain flat gate at the rim will serve as well as any other. Even where the casting shows a tendency to shrink or crack, the same style of gate may be changed to some slight extent to serve satisfactorily. Enlarging the area, or more properly speaking, the thickness of the gate immediately back of the restricted area where it joins the casting, usually is all that is necessary.

This slight change permits the casting to draw from the sprue just that little additional amount of feeding metal which represents the difference between a perfect and an imperfect casting.

Any reference to trolley wheels would not be complete without a description of a method which for some unexplainable reason has not been adopted as extensively as warranted by its merits. It is applicable only to small, plain wheels, that is to wheels without any openings through the web, or without any radial ribs.

The pattern equipment is too expensive where only a few castings are ordered, but where small sheaves are made in large numbers, there is no other method known to the present writer that can compare for speed, accuracy and the production of perfect castings. The method represents a radical departure from those usually employed in that the patterns are mounted vertically instead of flat and the cope and drag molds are made on the same side of the pattern plate.

Molds Are Stripped

The required number of *half* patterns, attached to a rod terminating at one end in a crank handle, are mounted on a cast iron stripping plate in such a manner that the diametrical line of each wheel pattern coincides with the face of the plate. Usually only one set of patterns is employed per flask, but in certain instances a double set may be arranged. For purpose of illustration only one set as shown in Fig.

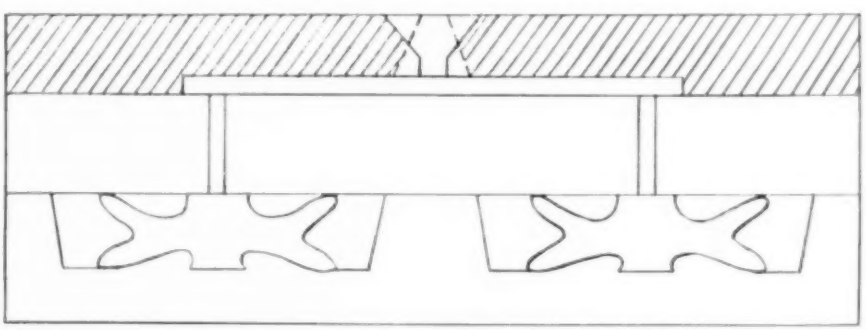

Fig. 192—Channels of runners in the bottom face of the iron weight on the cope conduct the metal to the vertical sprues

193 will be presented in the present instance.

Either a long narrow snap flask, or a number of small steel or iron flasks accurately planed and fitted may be utilized for making the molds. Obviously the flasks must be interchangeable. Obviously also the patterns must be arranged on a center line and also spaced longitudinally in such a manner that both halves of the mold made on the same plate, will coincide when the mold is closed. However, this is a detail within the capacity of any skilled patternmaker.

Brass or white metal patterns are preferable to steel or cast iron. They can be finished to a high degree of accuracy and smoothness and will not rust in the damp and corrosive atmosphere of the foundry. This is a feature worthy of consideration where operation is intermittent. While in active use, the patterns of any metal will remain bright and polished through constant abrasive contact with the sand.

No Skill Required

With everything in readiness and with the half wheel patterns projecting above the plate, the drag flask is set in place, filled with sand and rammed. The crank handle is given a turn through 180 degrees. A suitable stop on the end of the plate indicates when the desired point has been reached. The action of the crank and central rod impart a circular motion to the half wheel patterns which strips them through the plate, thus leaving the half mold ready to be lifted off and placed on the floor or on a conveyor.

The action of the crank then is reversed to throw the half patterns up through the openings in the plate and into their original position. The entire operation is repeated for the cope, with the single exception that a set gate and sprue are placed in position before the cope flask is filled with sand. In the ordinary routine a number of drags are rammed before the corresponding copes are prepared. The impression left in the sand by the long rod serves as a core print for the center core in the hubs of the wheels.

One of the advantages of this method is that it requires no skill on the part of the operator. Great speed of course only may be acquired through experience, but this experience readily is acquired.

The number of patterns in a flask and the desirability or undesirability of utilizing a double row, will depend on the size and more particularly on the thickness of metal in the castings. Molten metal when split up into a great number of small streams will only run a certain distance. Manifestly there is no advantage in using a large flask and a great number of patterns if the metal from a given sprue and driven through a number of necessarily constricted gate openings, will not fill all the mold cavities.

Unfortunately no statistics are available on the actual number of molds which constitute the limit, but for purpose of estimating the possibilities it may be said that at one plant eight 5-inch wheels are made in a flask 9 x 18 inches with a 4-inch deep drag and a 6-inch cope. This is approximately half the cubical flask capacity required for molding the wheels flat in the ordinary manner.

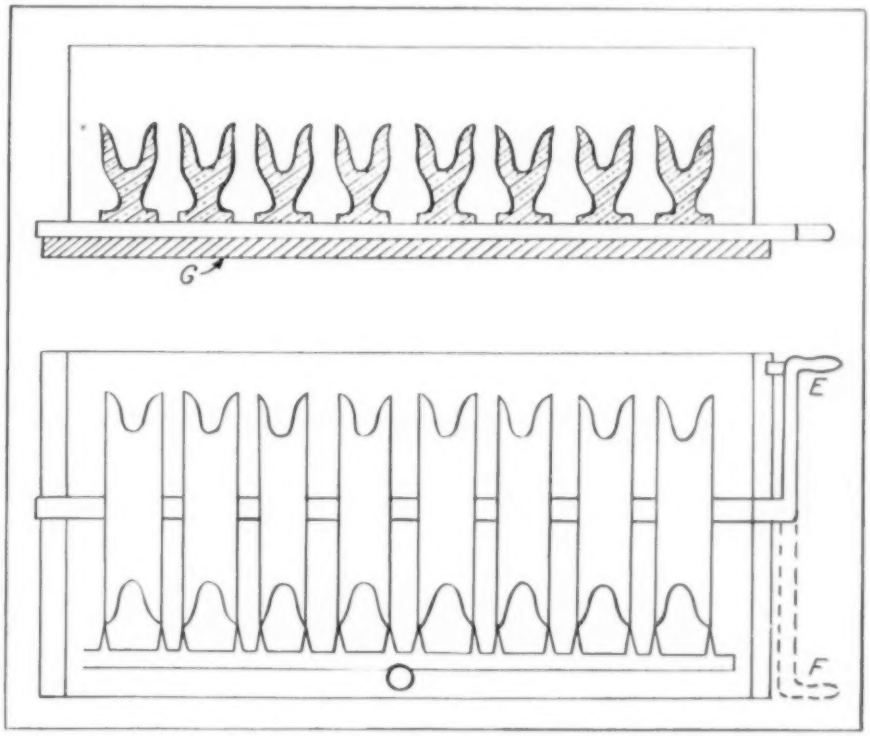

Fig. 193—By swinging the crank arm from E to F the patterns are revolved through a half circle from the top to the bottom of the stripping plate G

This is the thirty-seventh of a series of articles dealing with the various types of gates and risers used in the foundry industry. The thirty-eighth will appear in an early issue.—THE EDITORS.

Seeks Data on Engineering Materials

Charles H. Hughes, 2681 Amboy road, New Dorp, borough of Richmond, New York, is compiling a book on engineering materials for students, draftsmen and engineers. He desires to secure literature and data on engineering materials from companies producing such materials.

E. J. Hayden, Central division manager, Linde Air Products Co., Chicago, was elected president of the International Acetylene association at a recent meeting in Philadelphia.

Discuss Melting With Powdered Coal

Prof. Scott Mackay, University of Wisconsin, Madison, Wis., was elected president and J. Bissett, Wisconsin Appleton Co., Milwaukee, Wis., was made secretary of the Malleable club at the annual election of officers held at the Blatz hotel, Milwaukee, on Dec. 13. Twenty-seven members were present at the dinner and discussion which followed.

E. B. Hansen, manager, Wisconsin Appleton Co., addressed the members briefly on behalf of the executive group. He commended the work of the Malleable club and the excellent spirit shown by the members through their attendance and participation in the discussion. The balance of the evening was devoted to a discussion of powdered coal melting, the subject being continued from the November meeting.

Mineral Statistics

"Mineral Resources of the United States, 1931" is the subject of a report recently published by the United States department of commerce, bureau of mines. The publication contains a summary of statistics assembled from data furnished by specialists of the division of mineral statistics. The booklet is on sale by the superintendent of documents, Washington, for 10 cents.

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Rotary Furnaces

A New Steel Making Process, by Vincent C. Faulkner, *Foundry Trade Journal*, London, Oct. 13, 1932.

Mons Foundry Co., Belgium, has installed two Sesci furnaces, each of two tons capacity, for the production of steel castings. The author believes that this is the first time in history that a rotary pulverized fuel fired furnace has been employed regularly in the day to day production of light steel castings. The article discusses the various costs entering into the production of steel in the rotary furnace and also refers briefly to the quality of the product produced by the process.

Pumping Castings

Pumping in Foundry Practice (Le Pompage en Fonderie), by the Technical Committee of the Belgian foundry association. Rapporteur: M. Vandendries. *La Fonderie Belge*, Liege, July, 1932.

The technical committee of the Association Technique de Fonderie de Belgique is endeavoring to discover the laws governing contraction and piping to find a means of rational application of these laws to foundry practice. The use of heads to feed the molds has a bearing on the problem.

It is not always possible to place a head where it would give the best results; in such cases recourse is made to the use of heated iron rods, which are introduced into the mold through the head and stirred into the metal in an up-and-down movement. This is termed, in French, *pumping*. When the rod is sunk into the metal, it captures an amount of heat, which it gives back to the head in the upward movement. Conversely, the iron rod cools the metal in the lower part of the mold and activiate contraction inside the mold. The head is then fed with additional hot metal. As a result, there is a tendency toward better heat equilibrium between the outside and the inside portions of the metal in the mold, and less tendency to piping.

A discussion on this theory is given, and the conclusion is to the effect that *pumping* can give good results when carefully performed. It is especially beneficial for casting presenting massive parts which it is not possible to surmount by a sufficient head.

Making Cores

Cylindrical Cores in Loam (Noyaux Cylindriques en Terre), by the Technical Committee of the Belgian Foundry association. Third installment. Rapporteur: M. Vandendries. *La Fonderie Belge*, Liege, August, 1932.

This instalment deals with cores of large diameter, up to 30 inches, which are made on barrels placed horizontally on trestles. For the smaller diameters, from ¾-inch upward, the barrels are generally constituted by an iron tube with holes, which enable the gases to have an outlet. For the larger diameters, the barrels are made of cast-iron. The general procedure is, first, to wind straw around the barrel, which is then covered with the core sand, and the barrel is turned by means of a handle, while a strickle plate, which is placed over the barrel, enables the cylindrical core to form itself.

Melting Iron

Manufacture of Cast Iron in the Rotary Pulverized Fuel Furnace, by Dr. P. M. MacNair, the *Foundry Trade Journal*, London, Nov. 10, 1932.

Principles of operation of the rotary cylindrical furnace fired with pulverized coal are discussed in this article. The economic generation of heat from fine coal dust gives high melting temperatures with consequent fluid metal for a wide range of cast iron and steel composition. Owing to the high temperature, formation of slag with separation of metal from fuel, and rotation of the furnace, high quality cast iron can be produced, giving toughness and high tensile properties with freedom from inclusion and blow holes. It is pointed out the composition of the iron is under easy and accurate control.

In speaking of the metallurgical advantages of a good slag, the author states that in the open hearth and rotary type furnaces, once the charge is down, reactions take place along a definite line toward a point of equilibrium or neutrality. The iron oxide content is reduced with its consequent reduction in the metal, thus giving deoxidized iron which is degasified. Besides reducing metallic losses in the slag, this gives more important results in metal free from blow holes. The slag separates the metal from possible contamination by the fuel and the production of a low-iron slag high in lime assists sulphur removal.

Converter Design

New Toussaint-Levoz Converter, (Le Nouveau Convertisseur Toussaint-Levoz), by T. Levoz. *La Revue de Fonderie Moderne*, Paris, Sept. 10.

Methods employed in many steel foundries using the small converter are criticised severely, particularly with respect to construction of lateral tuyeres in horizontal fan-shape and the abnormal height of the tuyeres above the bottom of the converter.

In the design recommended there is a large air belt; the pressure of the air is higher than that usually employed, and the air enters the tuyeres at a greater speed. Tuyeres are inclined toward the bottom and parallel, or fan-shape, but converging toward the center of the converter. This design gives much more satisfactory conditions of oxidation, a higher temperature, the slag is easier to remove and it does not deteriorate the lining as much as in the case of the conditions criticised.

Foundry Training

A Proposed British Foundry Technical Training College, by Vincent C. Faulkner, *Foundry Trade Journal*, London, Oct. 6, 1932.

This article discusses the problem as to whether there is a demand for the creation of a centralized technical training institution in Great Britain especially organized for the tuition of students destined to become executive officers of the foundry industry.

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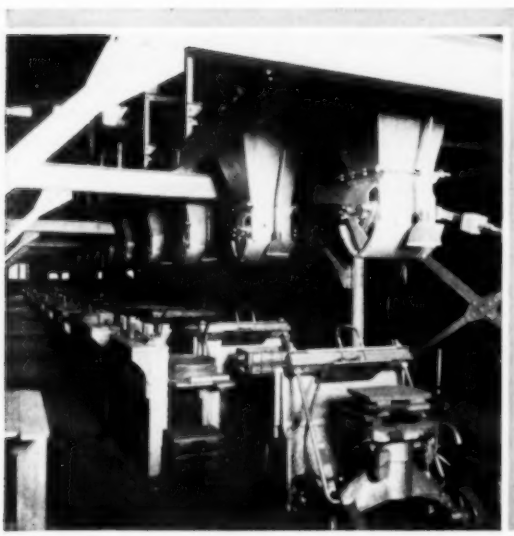

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Special Steels for Castings

(Continued from page 22)

ly predict the influence of any element on the performance of steel, except when a definite percentage of it and a stated proportion of each of several other elements (in some cases, all other elements) in the combination are under consideration. This is important to bear in mind when the consumer is accumulating data from the results of tests, laboratory or service; also, of course, when adopting a specification.

Adding to the complexity of the foundryman's problem (and emphasizing the factor of variety in properties), there are no less than 15 separate heat-treating procedures that may be applied to one day's output of a foundry making numerous alloy steels, if there are included in the total the different temperatures utilized for full annealing, for normalizing, and for drawing or tempering, and the practices for quenching in oil and in water, but without including in the list special operations for carburizing and nitriding. Many alloy steels are peculiarly susceptible to tempering influence, so that great differences in properties result solely from changes in the temperatures at which numerous grades are given drawing treatments, when the preliminary heating has been the same. This is not stated as a discovery made by the steel-casting industry. Reference to the matter is made now merely to emphasize the fact that the steel foundryman has not only in chemical composition, but in heat treatment, facilities almost without limitation for developing practically any desired combination of properties.

It is not surprising, in view of the tremendously flexible or versatile nature of steel, that this metal, put into castings regularly, may show (by intention and not by chance) tensile strength values per square inch ranging from 50,000 to 200,000 pounds, yield point values per square inch ranging from 25,000 to 175,000 pounds, and values for elongation and for reduction of area meeting any condition of ductility required for related stress resistance in the finished material.

Engineer Guided by Tests

To prevent the inference that the steel foundryman believes the engineer may safely be guided solely by the results of tension tests, mention should be made of other means of determining properties. Among methods not so well known as those applying tension, but better known than others of unstandardized character, is the shock or impact test, made either with Izod or with Charpy equipment. It is unfortunate in some respects that tests with each kind of machine are made, in view of the fact that there has been published no satisfactory method of interpreting either test in terms of the other. A conversion scale would serve an admirable purpose, but thus far the effort to produce one has presented insuperable difficulties.

A somewhat similar handicap exists in respect to other special tests, including that applied for producing fatigue, although there is not today so noticeably divided an opinion in respect to the machine best to employ for determining fatigue resistance as for ascertaining shock resistance. As a matter of fact, comparatively few fatigue tests are made. However, for some applications the results of such tests supply valuable information indicative of the life of the material. It may not be out of place to mention a fact, not realized by all engineers, that the term *fatigue* used in connection with metals, now is applied generally when it relates to the condition resulting from repeated reversals of stress. Thus, the fatigue test differs rather sharply from other laboratory tests, although fatigue strength apparently has a relationship to tensile strength. Prof. H. F. Moore, has reached the tentative conclusion that reversals of stress applied to a steel specimen under conditions like those developed by the R. R. Moore machine and in some other types for loading a rotating-beam specimen, generally show satisfactory resistance indefinitely, when the load is no greater than is represented by approximately 50 per cent of the strength demonstrated in the ordinary tension test of the steel.

Another method of approximately ascertaining serviceability in the laboratory consists in making the more or less familiar bend test. Here again there is no method that has become uniformly applied. It is recognized generally by metallurgists that one often may get a good or a bad bend test with specimens of the same dimensions, from the same piece of steel, around a given radius, according to the method of applying force to make the curvature, and according to the method of holding the specimen, to permit or to restrict movement under bending stress.

Harden Parts of Castings

Engineers generally are familiar with hardness tests, involving the use of brinell, scleroscope, rocwell, and other machines, which, in their adaptable fields of application, give valuable information regarding steel castings for some purposes. The practice of differentially hardening portions of steel castings to specified brinell or other values is steadily increasing, as a detail of technique ingeniously and effectively applied in foundries making alloy steels.

The manifest desirability of standardizing testing methods sometimes needed to determine approximately the serviceability of structural steels will some day result in general agreement regarding equipment and methods for making tests other than the well-known procedure applying tension. And in connection with steel castings applied for extraordinary purposes, like those resulting in creep under high temperature, and others markedly producing corrosion, abrasion, etc., there eventually will be developed general acceptance of machines and procedures that will give the consumer most of the information he wishes to know, so that prediction may be made with increased confidence, following the performance of laboratory specimens skillfully selected as being typical.

It has been indicated in the foregoing comments that tension test results fall short of telling the whole story. Nevertheless, frequently, but always as the result of convincing service behavior, tension test data are taken as the sole index of dependability, barring maximum percentages of phosphorus and sulphur prescribed generally. Only in rare cases is the laboratory specimen for any kind of test subjected to the combination of stresses exerted (often in several directions simutaneously) on the manufactured metal product in service. The equipment part as used by the engineer is stressed generally over long periods of time, and gets opportunities to rest, in many

Progress

RESULTS of remarkable developments in the chemical composition and heat treatment of steel castings are outlined in this article, which is from a paper contributed by the Machine Shop Practice division and presented at the annual meeting of the American Society of Mechanical Engineers in New York. The presentation includes a discussion of the influence of consumer demand on the steel foundry, casting significance of nomenclature and composition, and description and evaluation of laboratory tests. The second section of the paper, which will be presented in an early issue, will discuss diversified properties developed by heat treatment, varieties of alloy cast steels, characteristics of special steels for castings, and economy as the proper basis for metal selection.

applications; while the laboratory specimen is subjected to an accelerated test, in determining quality for purposes of manufacturing control or purchasing acceptance. The results of performance under stress during widely differing periods of time by no means always are identical.

Quite properly, the importance of laboratory tests grows with the increase of interest in special steels. The designer who considers using an alloy steel presumably having satisfactory resistance in a part of lighter weight than that of the piece formerly employed, has his interest in tests stimulated. Laboratory determinations need skillful interpretation; remembering not only the time factor in testing, but the inherent limitation, generally, in the application of simple rather than complex stresses set up in the testing machine. These comments are made, not with the motive of minimizing the admitted great importance of laboratory test data for steels of any composition, in wrought or in cast form, but to try to place such data in proper perspective, and incidentally to emphasize the inadvisability of selecting impulsively a new or unfamiliar variety of steel for a cast or wrought part to be subjected to extraordinary service conditions, on the showing of a few test data of restricted character. The average steel founder in the class regarded generally as competent should be solicited for advice in all such cases. His conservatism and conscientiousness are not apt to lead the purchaser into trouble, through exaggerated claims and overly optimistic expectations. Being scientifically, therefore analytically minded, the steel founder, like the mechanical engineer, resists inoculation from high-pressure salesmanship characteristics of recent years.

Many varieties of alloy steels are "eccentric," in that they require special shop technique for the successful manufacture of the completed article. Production details, such as those associated with heading, gating, shrinkage or contraction, sand practice, and cleaning, satisfactory for one grade of alloy steel put into castings, may be quite unsuitable for another grade of metal. This fact adds to the difficulty as well as to the fascinating nature of the alloy-steel-casting maker's problem. And the circumstance justifies caution by the consumer, in respect to two important details. First, foundry experience in making castings of a *temperamental* grade of alloy steel provides a measure of insurance. Second, a special kind of steel when forged or rolled, well adapted for some extraordinary purpose, is not always in cast form the grade properly suited for the same or a similar purpose. Obviously, then, the prospective purchaser should satisfy himself on the ability of the supplier to produce a dependable product and to give sound advice in respect to the variety of steel to be used, also, let it be said emphatically, in respect to casting design, always a vital factor, but more important in alloy-steel castings than in carbon-steel castings.

This is the first of two articles on "Special Steels for Castings." The second will appear in an early issue.
THE EDITORS

Depreciation and Obsolescence Affect Tax Evaluation Problem

THE annual meeting of the Malleable Iron Research institute was held at Hotel Cleveland, Cleveland, Dec. 14. The morning session was devoted to consideration of institute activities. A review of progress in metallurgical lines, the higher specifications which have been adopted and accomplishments in converting various types of products to the use of malleable were discussed. T. M. Harrison, Stevenson, Jordan & Harrison, Cleveland, presented a paper on time-setting by analysis of individual elements. Proper time-setting has a direct influence upon the control of labor cost, furnishes a stable basis for estimate and influences the final cost and price determinations.

Following the luncheon R. E. Sommer, Deahl & Sommer, Cleveland, discussed various factors tending to produce stabilized prices. He recommended compiling by an independent agency of information on current market prices, a trade conference agreement not to sell below cost and similar means to the price stabilization end.

E. E. Griest, Chicago Railway Equipment Co., Chicago, president of the institute, reviewed the accomplishments of the past year and announced the program for future undertakings.

Robert E. Belt, secretary, presented a detailed analysis of the relationship between depreciation and obsolescence, and state and federal taxes. Mr. Belt said that regarding plant values as related to county, state and federal taxes, he recommends writing off idle plant and equipment where there is no reasonable hope for its future need. This will have the effect of lowering state and county, and state franchise taxes. This will result in lowering insurance cost when there is an over-coverage, particularly where insurance is on the basis of pre-depression values. It also will reduce future depreciation charges which will make possible the preparation of more accurate statements.

The following officers were elected for the ensuing year: E. E. Griest, president; S. E. Doster, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., and F. O. Parker, Acme Steel & Malleable Iron Works, Inc., Buffalo, vice presidents; Robert E. Belt, Cleveland, secretary. B. O. Thomas, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, F. S. O'Niel, Link-Belt Co., Indianapolis, and O. J. Cessna, Albion Malleable Iron Co., Albion, Mich., were elected directors.

Book Review

A. S. T. M. Tentative Standards, 1932, paper or cloth, 1236, 6 x 9 inches, published by the American Society for Testing Materials, and supplied by THE FOUNDRY for $8.00 in cloth, $7.00 in paper plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster, London.

This volume is issued annually by the American Society for Testing Materials and includes all tentative standards in effect at the time of publication. The term *tentative* is applied to proposed standard which is given approval through the various steps of the A. S. T. M. procedure and which is published for one or more years to elicit comments and criticism. Although in the trial stage, these tentative standards are in wide use.

The 1932 volume includes all of the 226 tentative specifications, test methods, definitions of terms and recommended practices effective Oct. 31, 1932. Of that number, 47 were accepted for publication for the first time in 1932. Of the total tentative specifications included, 39 are devoted to ferrous metals, 20 to nonferrous metals and the remainder to a wide variety of materials. The new specifications for gray iron castings are included.

A. S. T. M. Regional To Consider Lubrication

A symposium on motor lubricants will feature the 1933 regional meeting of the American Society for Testing Materials, which will be held in the Hotel New Yorker, New York, March 8. This is the fourth regional meeting of the society, others having been devoted to automotive materials, welding and rubber.

The standing committees of the society will hold their annual spring group meetings in conjunction with the regional meeting, extending from March 6 to 10 inclusive.

Pours Steel Castings on Conveyors

(*Concluded from page* 12)

25 tons a day. Scrap for making up the charges is stored in bins in the yard immediately outside the furnace room and is carried to the furnace in small industrial cars operating on a narrow gage track.

Metal is tapped into a bull ladle, which is carried by a crane to the ladle car, operating on a short track at the center of the conveyor floor. The track is long enough so that the ladle car may be moved across the shakeout and, in the future, if the space there is devoted to floor molding of small work, will provide metal at the most advantageous point. As shown in Fig. 2, a monorail system is provided in front of the ladle car to carry a shank ladle along the pouring station.

Layout Is Efficient

An interesting layout has been provided to handle castings from the shakeout to the cleaning room with a small amount of effort. An industrial car operates over rails laid along the edges of the shakeout grating and also extending from the cleaning room to the center of the shakeout. A turntable at the center is used to shunt the cars from the shakeout track to the cleaning room track and vice versa. To save time and labor, the castings are loaded directly into pans, which are carried on the cars, and designed especially to load the castings into the tumbling and abrasive blasting combination type of machine built by the American Foundry Equipment Co., Mishawaka, Ind., and shown in Fig. 3. Work that is too large to be blasted in that machine is handled in a table type machine built by the same manufacturer. The combination type machine is self-unloading by simply reversing the direction of the conveyor carrying the castings under the blast nozzle.

A detailed study of the cleaning room problem has resulted in a layout which provides straight line production with a minimum of handling and lifting. After blasting, the castings are moved in boxes to the cutting table where the gates and risers are removed; the small ones with a sprue cutter and the remainder with oxyacetylene cutting equipment. After the gates and risers are removed castings are placed in metal boxes, located immediately in the rear of the cutting table, and moved on roller conveyors to the center of the grinding machine, shown in Fig. 4. The operator takes a casting from the box, performs the necessary grinding operations, and places it in a box at his side, which may be noticed in Fig. 4.

The castings in these boxes again move forward to the chipping benches, located immediately beyond the grinding machine as shown in the illustration. After chipping, the castings are passed across the table to inspectors. Castings are placed in boxes on the roller conveyor nearest the inspector and moved to the normalizing furnace shown in the background. If special welding is required a casting may be placed on the second roller conveyor, which carries it through the welding room where necessary work is performed. Such castings then are moved to the normalizing furnace.

The furnace is the continuous, gas fire, rotary type, supplied by the Holcroft Co., Detroit, and is shown in Fig. 5. About one hour is required for the castings to pass through the furnace, one half of the period being devoted to raising the metal to a maximum temperature of 1700 degrees Fahr. During the remainder of the period the castings are held at that temperature, which is controlled automatically. Castings emerging from the furnace are tumbled in two mills and then moved to the shipping department. In the future the company expects to provide conveyors which will move the castings from the furnace to the tumbling mills and from the mills to the inspection and shipping departments.

The molding, melting, sand handling and cleaning units have been tied together in such a way as to provide exceptional facilities for the manufacture of small steel castings on a production basis. Operating phases of the large castings shop of the Detroit Steel Casting Co. will be included in a second article, to be presented in an early issue.

Book Review

Handbook of Industrial Temperature and Humidity Measurements and Control, by M. F. Behar, cloth 320 pages, 6 x 9¼ inches, published by the Instruments Publishing Co., and supplied by THE FOUNDRY, Cleveland, for $4.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., Caxton House Westminster, London.

This volume contains Part II on temperature measurement and control and Part III on humidity measurement and control of the *Manual of Instrumentation*, which the author undertook several years ago. Due to the practical importance of heat control in the iron and steel industry, this manual should serve as a guide in the solution of numerous production problems.

Part II on temperature measurement and control contains chapters 5 to 11 inclusive and is devoted to a general discussion of temperature, and information on indicating thermometers, thermoelectric pyrometers, radiation and optical pyrometers, pyrometric cones, etc., temperature recorders, automatic temperature control, temperature control instruments and accessories. Part III on humidity measurement and control contains chapters 12 to 15 inclusive and is devoted to a general discussion of humidity and information on humidity measurements, humidity and aerological measuring instruments, and automatic control of humidity.

Industrial thermometry is treated in a comprehensive manner and represents detailed information on industrial rather than laboratory instruments. Pyrometry is dealt with under the usual main headings, thermoelectric, radiation and optical methods. The third major subject on temperature control represents considerable pioneering effort on the part of the author, who has laid down principles of correct temperature control. Humidity measurement and control is treated quite completely as far as the engineer rather than the scientist is concerned.

The author points out that a work on a new branch of technology must largely take the nature of a symposium rather than that of one author's writing. He points out that this handbook is no exception and that it has been made possible by the enthusiastic co-operation of many specialists who have contributed data. Much of the contents appeared serially in *Instruments*, but it is stated that many additions have been made in the course of revision.

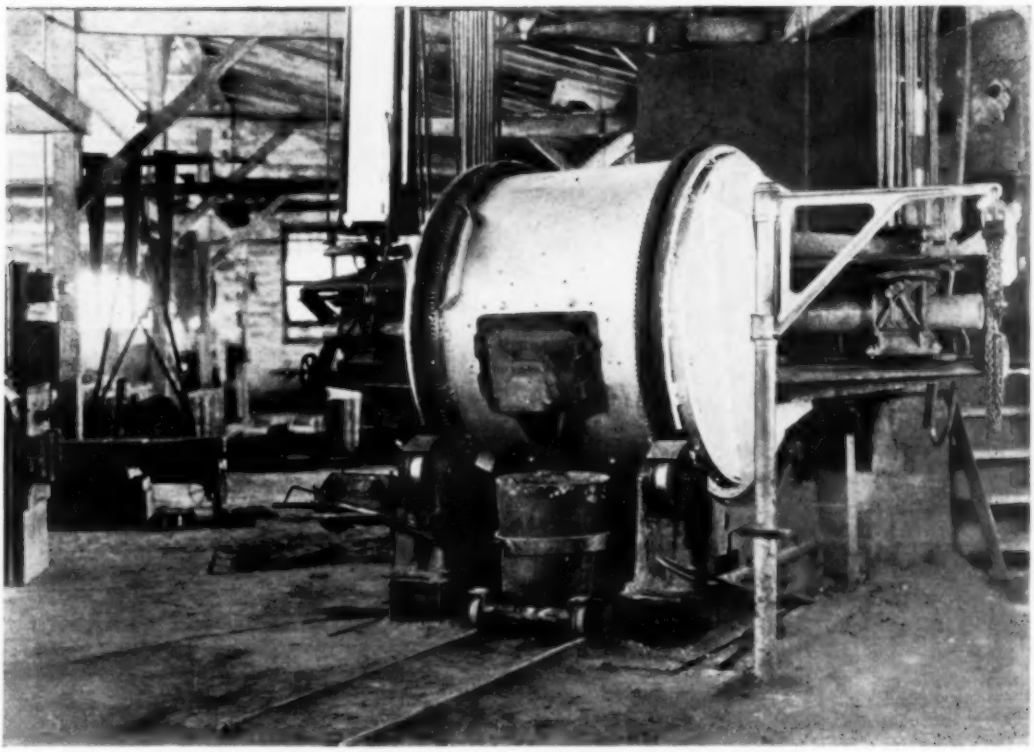
Indorses Plan To Put Men To Work

Warner & Swasey Co., Cleveland, recently expressed agreement with the idea credited to Louis Allis, the Louis Allis Co., Milwaukee, for the purpose of putting men back to work. The Warner & Swasey Co. has announced that while a substantial number of turret lathes are finished and held in stock, nevertheless, for each turret lathe purchased, the company will put men to work immediately building a new one of equivalent value for stock.

Discover Old Foundry

A news report published recently in the *Chicago Herald and Examiner* states that a prehistoric foundry dating back to about 1000 B. C. is reported to have been discovered in the Seitendorf region of Germany following recent landslides. The foundry contains a number of well preserved furnaces.

A Metal Melting Machine



3000 / 6000 lb. Detroit Rocking Electric Furnace Installation

No Miracle . . No Alchemy

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DETROIT ROCKING ELECTRIC FURNACE

But it does effectively facilitate accurate control of analysis and of temperature, and its rocking action insures homogeneity and absolute uniformity throughout the bath,—all essential factors in the economical production of good castings.

ASK THE MAN WHO USES ONE!

Detroit Electric Furnace Co.

829 W. Elizabeth St., Detroit, Mich.

When Annoyed to Exasperation

(*Concluded from page 23*)

before the buyer's own eyes, and demonstrate its satisfactoriness there and then. But the buyer would neither give the salesman permission to do this, nor allow any test to be made.

It was after a fruitless visit that the salesman lost his temper, and did what might be considered a rash thing. He sat down, when he reached his hotel, and wrote a personal letter to the president of the company in question, signed it himself, and posted it before his anger cooled. It ran something like this:

Dear Mr. Smith,

You've known my firm and me long enough to believe that on the whole we've given you good service during our business connection. I'm writing now to ask you to ask yourself a sensible question. Does it seem reasonable to you that, decency apart, we should run the risk of losing a fine business like yours for the sake of a few extra pounds' profit?

After all, our firm's as big and as well known as your own, and we've got just as good a name for fair-dealing. Why you should suddenly take it into your heads that we've turned into a lot of swindlers, I don't know. We've got the same staff in the foundry as we had ten years ago, and they haven't forgotten how to make steel castings, whatever your folks think. In any case, I should have thought that after all these years, you'd at least have given us a chance to prove our points.

What's wrong with the castings you've sent back is simply damned carelessness in your heat-treating shop. I don't know whether you've got your office-boy in charge there, but I should get the laborers to give him a few lessons in the elements of the art before you let him try his hand on the next man's castings.

Yours sincerely,
John E. Monroe

That, from some points of view, is a simply appalling letter. It is not only angry, it is insulting. It sneers. John E. Monroe is obviously annoyed. He is in the state of mind when little more would have been needed for him to tell his correspondent to go to hell. But the point about the whole letter is that its perfect sincerity produced an effect that a conciliatory letter could not have done. The salesman received a reply by return, signed by the president, asking him to call. He did so, and found that all sorts of investigations had been made in the meantime.

There had been a change in the heat-treating shop which had led to an insufficiently experienced man being set to work on the castings. The buyer had not troubled to make adequate inquiries, and had been reassured too easily by a man eager to hide his faults. He had acted on the assumption that "the manufacturer is always in the wrong," and had rejected the castings forthwith, refusing all explanations. To cut a long story short, amicable relations were re-established, and what seemed a good business lost forever was regained by a bad-tempered letter.

The truth is that a certain type of buyer exists whose delight is to bully and hector the conciliatory salesman. Sometimes he is an assistant promoted, and the novelty of his newly-acquired power runs away with his manners. Often the turning of the worm—if one can postulate for a moment a salesman who resembles a worm—will bring him to his senses quicker than any amount of polite expostulation. There are few men who do not secretly respect one who has the courage, knowing his dependence on their favor, to turn and go for them hammer and tongs.

Quotes Fathers' Experience

If I may here introduce a reminiscence, I would like to quote an instance that occurred during my own father's travels. He had called several times on a certain buyer, who seemed to extract misanthropic enjoyment from his sarcastic attacks on the various salesmen calling upon him. He would sneer at them, their goods, and the firm they represented; and the more they cringed, the better he liked it. What made it worse was that he had big orders to place. Otherwise, he would never have got a salesman to go near him.

After being treated in this abominable way on several occasions, there came a time when our salesman saw red. He suddenly turned on the buyer, gave him in choice and expressive language a brief summary of his status on this earth—it was somewhere among the entozoa—and after indicating an appropriate repository for his soul after death, stalked out. He was somewhat surprised to receive by mail, an order of good size from this self-same buyer, twenty-four hours after the memorable interview recorded. He learned afterward that his new customer had discovered a sudden admiration for the courage of the first salesman who had "stood up" to him, and had decided to reward it.

There is, too, the man who unknowingly gets into the habit of being abrupt and unreasonable with salesmen. Usually he is a nervy, irritable, busy sort of man, to whom salesmen are only walking advertisements occupying a good deal of his valuable time. It will sometimes bring a man of this sort to see that salesmen are human beings after all, if one of them—himself nervy and irritable, perhaps, after a hard day's work—shows by a sudden loss of temper that he can be hurt up to the point of hitting back.

It must not be assumed that this article advocates ill-temper. Far from it! It is merely a contribution to foundry sales psychology, and is not to be taken as a formula for order-getting. The one justification for losing his temper, whether during an interview or by letter, is that a man is driven to it by unfair treament and has right on his side.

Unless he is undeniably in the right, to lose his temper is merely silly, and will do far more harm than good. But if he feels sure the other man is in the wrong, it sometimes pays to tell him so.

Steel Founders Announce Annual Meeting

Steel Founders' Society of America will hold its annual meeting at the Statler hotel, Detroit, on Thursday, Jan. 19. The meeting will coincide with the Highway and Building Congress in which the Steel Founder's Society of America is participating, thus affording delegates an opportunity to see the road show and other attractions in connection with the congress.

Arthur Simonson, Falk Corp., Milwaukee, president of society will preside at the general sessions. Granville P. Rogers, managing director, will report on the society's work and other important matters will be considered as well as the society's program for 1933.

In addition to the usual discussions of general business conditions and reports of active committees, Frederick A. Melmoth, vice president, Detroit Steel Casting Co., Detroit, will speak on "United We Stand,—?." The paper will provide a comparison of progress made by the industry in technical and manufacturing processes as against the advances made in selling, merchandising and distributing.

Malcolm W. Bingay, editorial director, *Detroit Free Press*, will be the guest speaker at the noonday luncheon.

Buys Company

Gould's Pumps Inc. has acquired the Hydroil Corp., Lebanon, Ind., manufacturer of oil purifying apparatus. The Lebanon plant is being discontinued and the business and equipment transferred to the Seneca Falls plant of the Gould company. D. B. Clark, vice president, Hydroil Corp., and W. P. Alexander, factory and field representative, will join the Gould organization.

The American Ceramic society will conduct its annual convention in Pittsburgh, Feb. 12-18.

The Foundry Through the Years

(*Concluded from Page* 14)

for aircraft, the foundry industry played a leading part in meeting the urgent demands for fighting ships. Charles Vickers, in an article "Metals Used in the Construction of Aircraft" told what prominent parts such metals as cast iron, semisteel, aluminum, brass and bronze were playing in the successful production of airplanes. A later article was entitled "Metallurgy of Cast Iron Airplane Cylinders."

Alert to the possibilities for greater service, THE FOUNDRY now directed attention editorially to the use of semisteel projectiles by the Allies, and suggested the possibilities presented through their use by the American forces. In the following issue, it presented as the lead article, a valuable contribution by E. Ronceray, Paris, on "How Semisteel Shells Are Being Made in France." This campaign soon bore fruit, and in September of that year THE FOUNDRY announced that the ordnance department had placed orders for approximately 1,000,000 semisteel shells.

Sees An Iron Shortage

In meeting the needs of steel works for pig iron, the pressing requirements of castings manufacturers were not being given proper consideration. This alarming condition was brought forceably before the foundry industry and the authorities in Washington in the lead article of the April issue on "A Great Shortage of Foundry Iron Is Impending." Immediate relief was deemed necessary by the editors. To agitate the situation further, THE FOUNDRY pointed out in May that no relief was in sight for the pig iron shortage.

In time the exigencies if the situation became apparent to those in authority, and in June, THE FOUNDRY stated that the threatening shortage of foundry grades had resulted in government action to assure an ample supply for essential requirements. At a time when delay might mean disaster, the board taking that action failed to define essential requirements, so THE FOUNDRY again stressed the need of action editorially in the June issue and also in the lead article of the July issue.

In July, an article by H. W. Gillett and A. E. Rhodes on "Melting Brass in a Rocking Electric Furnace" pointed to a "marvelous development of great value to the nonferrous casting industry, resulting from experiments conducted under the supervision of the bureau of mines." Since that time the furnace has been adopted widely, and is used not only for melting nonferrous metals, but for gray iron as well.

"Winning the War" and "The Conservation of Man Power" were the keynotes of the great convention and exhibition of the American Foundrymen's association, held the week of Oct. 7 in Milwaukee. The presence of distinguished French officers gave international color to the convention and brought home the need of contributing effectively toward the winning of the war. President Fuller, in his address, pointed to new problems in the war service, and Capt. R. A. Bull, writing from the Western Front, stated that the men in the trenches "are confidently looking toward America for the supreme manifestation of speed and efficiency of which her people are capable."

Then the war was over—the armistice was signed. In peace as in war, THE FOUNDRY immediately was called upon for leadership and in the December issue, addressed the industry on "Readjusting Foundry Business to a Peace Basis." Speaking editorially of the reconstruction, THE FOUNDRY said "one of the beneficial effects of the war period in the foundry was the accelerated installation of labor saving equipment made necessary because of the declining man power of the country." This movement toward labor saving equipment was to continue throughout the next decade.

F. G. S.

Describes Plant At Chicago Meeting

Gottfrid Olson, Illinois Malleable Iron Co., was elected president of the Chicago Foundrymen's club at a meeting held Jan. 5 at the Great Northern hotel. About 50 members of the club were present. Other officers elected include: Vice president, Donald J. Reese, Whiting Corp.; secretary, A. N. Wallin, S. Obermayer Co. The board of directors also elected includes: R. E. Kennedy, American Foundrymen's association; D. G. Anderson, Western Electric Co.; L. E. Gilmore, Crane Co.; Roy Frazier, Hansell-Elcock Co.; P. Mate, Greenlee Foundry Co.; T. Mauland, International Harvester Co.; E. E. Griest, Chicago Railway Equipment Co.

M. J. Gregory, manager, foundry division, Caterpillar Tractor Co., Peoria, Ill., was the principal speaker of the evening, discussing important features of the company's new foundry as well as several phases of foundry practice as carried on there. A detailed description of this plant was presented in the May 15, 1930 issue of THE FOUNDRY. Mr. Gregory related the company's experiences in pouring high test and base iron in the production of various tractor parts, detailing the proportions of different materials charged into the cupola. Nickel content in the iron is derived from nickel steel turnings received from the machine shop. Considerable of the scrap consumed is in the form of briquettes.

In the pouring of the diesel engine liner it was found that liberal use of risers reduced markedly the number of defective castings, although the weight of gates and risers practically was equivalent to that of the casting itself. Mr. Gregory stated that a survey of melting losses in the cupola gave an average of 4.66 per cent, varying from 3.2 to 6.4 per cent during the period in which this check was made.

Gen. J. S. Hammond, president, Whiting Corp., Harvey, Ill., and also president of the American Foundrymen's association and of the Illinois Manufacturers' association will address the next meeting of the Chicago Foundrymen's club, Feb. 2, at the Great Northern hotel.

Gray Iron Institute Will Meet in Chicago

A general meeting of the Gray Iron institute will be held at the Congress hotel, Chicago, Thursday, Jan. 26. A number of new developments affecting the industry will be presented and discussed. The portion of the program which will be given over to marketing problems and plans which the technical and merchandising committees of the institute have developed will be of particular interest. A business leader will talk on a timely subject. All gray iron foundrymen are invited to attend the meeting.

Publishes Reports On Combustion Studies

American Gas Association, Inc., through its committee on industrial gas research, recently had issued three bulletins on different problems of combustion. Report No. 692 entitled "Research In the Elimination of Noise in Industrial Gas Burners" consider noise produced by industrial gas burners as affected by the mixture burned and the character of the installation preceding the burner body. Report No. 685 is entitled "A Study of the Characteristics of Burning Gas With Pre-Heated Air." Report No. 694 is entitled "Standard Nomenclature for Industrial Gas Combustion Systems."

Wisconsin Foundries Co-operate

(*Continued from page* 17)

qualified to properly diagnose for this disease, which was of comparatively recent development in our industry, and there was a possible danger of some of these cases pending being settled by the compensation insurance companies without the proper kind of medical testimony being presented at the trials before the commission.

One large insurance company in our state, the Employers Mutual Liability Insurance Co., that carried approximately 70 per cent of the compensation policies on foundries in our state, had assured Mr. Falk that when he and his committee had found, in their investigation, a silicosis claim which they felt would make a good test case, they would be willing to follow any procedure which might be suggested. A short time later a case developed which the committee considered would answer this purpose.

The plaintiff in this suit was a man 65 years of age who had been a molder for 32 years. His original complaint, as diagnosed by his own physician, was a saculation on the large vessel leading away from the heart. From x-ray plates, his physician at the first hearing, testified to this condition and pointed out an enlargement of the *aorta* the size of an orange. He also testified that this man's condition was the result of his work and the condition was common among molders. Incidentally we might say here that it was found that this man had a lateral curvature of the spine and the seeming enlargement on the aorta was due to this condition causing a large vessel to be pushed to one side, making it more prominent.

Examined by Doctor

The attorney for the insurance company did not want this case to rest on this doctor's testimony so requested permission from the commissioner to have the plaintiff reexamined by another doctor. The doctor employed for this examination reported he was of the opinion the plaintiff's disability was not caused by his heart condition, but in the main by silicosis. The employer of the plaintiff, having no acquaintance with either of the two doctors making diagnoses, decided they would have the plaintiff examined by a doctor who had considerable experience in this particular disease. All of the x-ray plates which had been taken by both of these doctors were sent to Dr. W. J. McConnell of the Metropolitan Life Insurance Co. who in turn sent them to two doctors who were by national repute, considered to be authorities on this disease. Both of these authorities reported that this employe's disability was not caused by silicosis.

The plight in which this employer found himself as a result of these conflicting medical testimonies, was explained to Dr. H. K. Pancoast of the University of Pennsylvania who was one of the authorities to whom these plates had been forwarded. We succeeded in prevailing upon Dr. Pancoast to come to Wisconsin for the purpose of aiding us in this work. The day before the trial Dr. Pancoast made a complete examination of the plaintiff and ordered new x-rays taken according to the technique which he prescribed. On the day of the trial he occupied the witness stand for approximately 4 hours giving a complete diagnosis of the case and explaining the methods employed in so doing.

Mr. Pancoast explained that from the testimony he had listened to, he could not help but think that the doctors had not made a complete diagnosis, having failed to make stereoscopic films or lateral views of the chest, or conduct a fluoroscopic examination, all of which he and his associates felt were essential to a complete and proper diagnosis of silicosis. An opportunity had been given him to view the plates from which the doctors for the plaintiff had made their diagnoses and those he condemned from a roentgenologist's standpoint, pointing out that the films referred to had not, he thought, been properly exposed, substantiating this statement with the explanation that due care should be exercised in securing the proper exposure and penetration on chest films for the reason that under-exposure tended to exaggerate or bring out too much while over-exposure produced the opposite effect.

The outcome of this trial was a verdict in favor of the defendant.

Wisconsin Experience

GOOD foundry housekeeping is the first constructive step toward the elimination of dust hazard in the foundry industry. This point was emphasized by E. O Jones, Belle City Malleable Iron Co., Racine, speaking at a meeting of the National Founder's association in its New York meeting. In the accompanying abstract of Mr. Jones' address is outlined the experiences of Wisconsin foundrymen in meeting the problem of damage claims based upon alleged health impairment due to inhaling silica dust.

Now the question which prompts itself is "What was accomplished in this test case?" To summarize:

1. The commissioners were given their first opportunity to listen to the testimony of an authority on silicosis.
2. Notice was served on the unethical men in the legal and medical profession that we were prepared to combat their inexperience in diagnosis of this disease.
3. A clinic by Dr. Pancoast in Milwaukee after the trial was conducive to awakening a genuine interest among our medical men in this comparatively new disease and acquainting them with its many complications.
4. The interesting fact was brought to light in this particular case that the plaintiff, a man of 65 years of age, 32 of which were spent in the foundry as a molder, had not contracted the disease to a disabling degree.

By way of suggestion, based on our experience in Wisconsin we would recommend that all cases be investigated thoroughly and that in every case medical services of a thoroughly reliable nature be enlisted.

Formulate a Program

During the course of these events Mr. Falk and his committee were formulating and carrying out their program. We have referred to the Employers Mutual Liability Insurance Co. previously in this report and have mentioned the fact that they carry the compensation policies on 70 per cent of the foundries in our state. Therefore, they were vitally interested in our situation and kept in close contact with Mr. Falk's committee. The outcome of these conferences was that this company established a complete dust laboratory for the purpose of testing and determining the amount of harmful dust in the air at a given time and in different places in a plant. This laboratory was put in charge of Dr. E. G. Meiter who was associated with the United States bureau of mines, Pittsburgh. He is one of the outstanding authorities on this line and on harmful gases and also for the proper equipment to combat those dangers. Dr. Meiter has not only made many dust counts in the different plants and determined the amount of silica contents in the dust, but he has also spent considerable time in consultation with manufactnrers in reference to the proper equipment to safeguard the lives of the employes.

After some of these studies had been made, the insurance company decided that they woud hire a competent ventilating engineer, in the

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assumption that his services along with Dr. Meiter's would help to bring about the most effective results in the shortest possible time.

The outcome of this service made evident the fallacy of the idea that it would be necessary to purchase new equipment involving large expenditures of money, as it was found that with proper supervision, and the repair and maintenance of equipment already installed, we could materially reduce the dust at its source. We could here enumerate many practical instances to substantiate this statement from field notes of the men who made these studies.

After eliminating dust at its source as much as possible our next step was to clear the interiors of foundries of the accumulation of loose dust. This was accomplished in various ways, such as the use of water pressure by air, or merely brushing. In many instances this cleaning was followed by a painting of the interiors with white or aluminum paint.

Floors Are Kept Clean

Floors and gangways are kept clean from accumulations of loose sand and whenever practicable, gangways and aisles are kept moist by sprinkling. All refuse material is thoroughly moistened before being moved from the foundry. Floors are all thoroughly sprinkled before they are swept.

In many plants wind charts have been provided so that most favorable results can be obtained from natural ventilation.

The more recent move in connection with silicosis is the establishment by the Employers Mutual Liability Insurance Co. of an x-ray laboratory for the purpose of physically examining not only the new employes who may be going into a foundry, but also those who have been in the foundry for sometime. This laboratory has been put in charge of a doctor who has had a number of years experience in chest work and we also have the promise of the U. S. government that this work will be directed for some months by a member of the government bureau of health who has had many years experience in the silicosis hazard. In addition to the doctor there will be an x-ray laboratory technician and a general technician for the purpose of examining blood and other physical conditions of the employe. In this connection they will keep a complete card index of all employes either working in the foundry industry or making application, and in this way make the laboratory a clearing house and center from which the foundry industry can be assured of securing none but healthy individuals from a chest standpoint, at least, where the occupation is to expose them to any of the dust hazards.

We have been challenged by a serious problem, and the most effective way in which we can meet this challenge is through prevention and control—prevention of conditions which are contributory to the contraction of this disease, and control of such conditions as may encourage or augment it; in other words, good housekeeping should and must be our earnest endeavor at all times.

Conversion Factor Approved by Conference

A conference of delegates under auspices of the American Standard association, held in New York recently, firmly approved 25.4 as the conversion factor between inch and millimeter values for industrial use in this country, according to a recent article in *Ford News*. In other words, 1-inch will be 25.4 millimeters. By that action, the conference referred to leaders of industry the acceptance of the proposal, no question existing as to unanimous approval everywhere.

Need Revival In Sales Activities

"What selling needs today is a good old evangelistic revival," Frederick B. Heitkamp, general sales Manager Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, said in an address before the industrial marketing conference of the American Management association in Pittsburgh recently. "The spirit which causes men to do better than they believe possible seems to be lacking and needs to be brought back," Mr. Heitkamp continued. "Probably it isn't so necessary to discard old successful methods as it is to find a new dress for such methods, or to resurrect many of them which we have so long overlooked that they will appear new when brought to light again."

Among the personal qualifications in the sales force which are most important under present conditions, the speaker said that courage comes first and hard work, second. To be added to such qualifications are vision, optimism, loyalty, willingness, perseverance sense of humor, good health, a forceful but sympathetic temperament, and an ability to work with head up. "Conditions which we have experienced during the past two years have automatically eliminated the ordertaker," Mr. Heitkamp said.

When a company is confronted with a problem of knowing whether it is profitable to keep members of its sales force on a part time basis or materially to reduce the number of those employed, Mr. Heitkamp indicated that, except in rare cases, it is highly improbable that the part-time idea can be followed with success. "It is probably better to reduce the sales force and increase the size of territory covered by the men," Mr. Heitkamp said. "To keep a man on part time tends to break down his morale, because it is frequently impossible for any one of the men to make a satisfactory financial showing."

"The days ahead are days of harder work," Mr. Heitkamp said in conclusion. "They are days in which the best man is going to win—the best man on your sales force and on mine—the best sales force in one industry against a competitor. The best sales force of one manufacturer against that of his competitor. It is going to be a race with the survival of the fittest—a survival of the producer. Management has its responsibilities—to show courage, to show leadership—to take initiative and to pioneer. Sales executives will be charged with the responsibility of suggesting and executing policies which will release pent up capacities and which will arouse sufficient enthusiasm."

Quad City Group Hears Talk on Russia

Harold Metcalf, Davenport attorney, who recently returned from an extended tour through Europe, addressed a meeting of the Quad-City Foundrymen's association, which was held on Dec. 19 at Fort Armstrong Hotel, Rock Island, Ill. Mr. Metcalf spoke on "What I Saw in Russia" and told of his observations of the working of the governmental experiment there. Following the talk many interesting remarks were made by those present, including John Ploehn and P. T. Bancroft.

F. W. Kirby, superintendent, John Deere Spreader Works, gave a short talk on "Farm Relief Legislation." The meeting was in charge of Charles F. Scherer, Davenport Machine & Foundry Co., and president of the association.

The next meeting will be held in Davenport on Jan. 23.

Index to Standards

An index to American Society for Testing Materials standards and tentative standards recently has been issued. The publication gives titles of all society standards under appropriate key words, together with references to the publications in which the standards may be found. Each standard is indexed under the principal subjects covered.

Uses Insulated Covered Ladles

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average life of 4 days in service.

The temperature of the outside shell on the new type ladles is approximately 350 degrees Fahr. as compared with an average temperature of 850 degrees Fahr. for the old type ladles.

By comparison of the two curves in Fig. 4, it will be seen that a superheat of 190 degrees Fahr. now is required as compared with the 370 degrees superheat formerly necessary before the development of the new type ladles and the change in cupola charge and operation.

The change in the cupola charge consists of using a larger quantity of a different kind of coke and the substitution of some of the less expensive make-up charge for part of the pig iron charge. The increased coke cost is offset entirely by the cost of the make-up charge.

Based on an average yearly production, the above methods of operation show the following results:

1. Reduction in energy consumption required for superheating by 40 per cent.
2. Reduction in the electrode consumption by 45 per cent.
3. Increase in the capacity of the electric furnaces by 65 per cent.
4. Reduction in the amount of foundry spillage by 48 per cent.
5. Increase in temperature of the last iron out of the pouring ladles by 75 degrees Fahr.
6. Reduction in the overall ladle maintenance by 5 per cent.
7. Improved working conditions for the foundry in general, and especially for the iron pourers and shifters due to cooler atmosphere and the ease of handling the new ype ladles.

The new type ladle is responsible for approximately 50 per cent of the first three items mentioned above and practically all of remaining items.

Engineers Hear Discussion of Malleable Iron and Alloy Steel Castings

MALLEABLE iron and special steels for castings featured the discussion at the foundry session of the Fifty-third annual meeting of the American Society of Mechanical Engineers at the Engineering Societies building, 29 West Thirty-ninth street, New York, Dec. 5-9, Stanley G. Flagg, Jr., president of Stanley G. Flagg Inc., Philadelphia, presided.

Presenting a paper on special steels Maj. R. A. Bull, director, Electric Steel Foundry Research group, Chicago, discussed the diversified properties developed by heat treatment, the varieties of alloy cast steel and the characteristics of special steel for castings. He said the industry is free to employ countless combinations of potentially useful elements that, after proper heat treatments, will provide desirable properties in the steel castings. He declared that a huge task had been assumed by the steel casting industry in determining, by actual experiment, what properties result in combinations reasonable to consider from the standpoints of first cost and economical service.

Commenting on the growth of alloy steel production in the foundry industry, particularly since the world war, Mr. Bull stated that today out of perhaps 280 plants in the United States producing steel castings more than half have one or more electric arc furnaces installed. During the last 5 years the electric branch of the industry has witnessed the birth, commercially speaking, of a new small subdivision of its own branch, resulting from the installation of induction furnaces.

Reflecting further the growth in alloy steel casting production, the speaker said that in 1921 the output was less than 7.2 per cent of all steel castings made in the United States, whereas, in 1931, a depression year, the proportion of alloy steel castings rose to more than 17.3 per cent and totaled more than 100,000 net tons.

High Physical Properties

In discussing the characteristics of special steels for castings, the speaker declared that alloy steel castings now are being produced more or less regularly with yield point values up to 180,000 pounds per square inch and tensile strength values that some times appreciably exceed 200,000 pounds per square inch. Ductility values in these high strength steels vary considerably.

Mr. Bull declared that the consuming industry appears to need a scheme for classifying steel castings. The absence of such a scheme has probably to a large extent been responsible for the frequent selection of trade names given to varieties of cast alloy steels. The speaker believed that the trade name habit has produced some confusion and that in this circumstance is one of several justifying a movement that may be inaugurated and that might result in a classification nomenclature that would be self indicative to engineers.

Malleable iron as a component part of machines and structures was the subject of a paper by Enrique Touceda, consulting engineer, Malleable Iron Research institute, Albany, N. Y. He discussed the properties of malleable iron and its machineability, also size restrictions and competitive materials.

In treating certain metallurgical phases, the speaker devoted attention to phosphorus and sulphur and touched on the strength and ductility of malleable as related to surface and interior sections. Corrosion resistance was discussed; also the adaptability of malleable for machine parts.

In a written discussion, H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, took exception to certain points suggested by Mr. Touceda. He said that all engineers do not agree that the strongest malleable iron is for every purpose the most desirable. He added that those who prefer a weaker iron do so from consideration of improved machineability, soundness and so on. He said that some of the largest malleable manufacturers have never taken an active interest in the higher strength material.

Audrey A. Potter, dean of engineering, Purdue university, Lafayette, Ind., was named president of the A. S. M. E. to succeed Conrad N. Lauer, Philadelphia, while the following vice presidents were announced for 1933; James D. Cunningham, president of the Republic Flow Meters Co., and of the Auto Gas Corp., Chicago; Harold V. Coes, manager of the industrial department of Ford, Bacon & Davis, New York, and director of the American Management association; and C. F. Hirshfield, chief of the research department of the Detroit Edison Co., Detroit, and former professor of Mechanical Engineering at Cornell university.

The following managers were named: Alex D. Bailey, superintendent of generating stations, Commonwealth Edison Co., Chicago, John A. Hunter, professor of mechanical engineering, University of Colorado; and R. L. Sackett, dean of the school of engineering, Pennsylvania state college.

Strength of Steels

"Tensile Properties of Cast Nickel-Chromium-Iron Alloys and of Some Alloy Steels at Elevated Temperatures," by William Kahlbaum and Louis Jordan, has been published as research paper No. 474 by the bureau of standards. The paper may be secured from the superintendent of documents, Washington, for 5 cents.

Deoxidizers for Brass Alloys

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essary first to make a hardener by alloying one pound of 80 per cent ferromanganese, 3 pounds of wrought iron and 36 pounds of tin. This is cast into small ingots. The bronze is made by charging 88 pounds of copper into a crucible, adding 10 pounds of the rich alloy previously made, and following with 2 pounds of zinc. The analysis of the alloy is as follows: Copper, 88.67 per cent; tin, 8.88 per cent; zinc, 1.45 per cent; iron, 0.79 per cent; and manganese, 0.11 per cent. This mixture is supposed to make a strong alloy, but it does not compare with the 40 per cent zinc alloy.

During recent years a copper-manganese alloy has been patented which contains 78 per cent copper, 20 per cent manganese, and 2 per cent phosphorus. This alloy is fluid when cast in die molds and the fracture presents a steely appearance and a fine grain. Evidently the alloy is not intended for sand castings, for when cast in sand molds black streaks will be found on the surface of the casting and the skin underneath will be shrivelled. The fracture shows coarse crystals and the alloy is weak.

Making Malleable Nickel

Manganese has been used for many years as a deoxidizer for german silver and nickel alloys in general and several patents for the use of manganese in promoting malleability in nickel and nickel alloys have been taken out. In 1878 Theodore Fleitmann of Germany patented the use of magnesium in producing malleable nickel which could be rolled into sheets and drawn into wire. He advocated the addition of 0.5 per cent of magnesium for that purpose. Later experience of Fleitmann and others resulted in supplanting magnesium by manganese. He then developed a nickel flux containing 51.43 per cent nickel, 46.77 per cent manganese, 1.15 per cent iron, and 0.65 per cent silicon. At that time it was considered that manganese was superior to magnesium as deoxidizer of nickel alloys. While magnesium rendered nickel malleable, the dross and oxide formed intermingled with the metal and practically defeated the object attained by the deoxidizing process.

Deoxidizing any alloy constitutes merely an exchange of oxides, and it often is a question whether the new oxide is in any way superior to the original one. If it is volatile, it may remove itself from the metal. Manganese dioxide is a solid body, the same as magnesia, the oxide of magnesium, so that as far as an exchange of oxides is concerned, there does not appear to be much choice. However, both manganese and magnesium are used at present, and it is customary to use manganese in some cases and magnesium in others. Magnesium finds application frequently as a deoxidizer in metal for sand castings, while manganese more often is used in nickel alloys that are rolled or drawn into wire.

In such alloys as Benedict nickel, 0.10 per cent manganese usually is added. Wood in his *Waterbury Book of Alloys* recommends the addition of 3 ounces of 30 per cent manganese copper as the deoxidizer for Benedict nickel, and 5 ounces of 30 per cent manganese copper for cupro-nickel bullet jackets. In a paper on brass rolling mill alloys presented before the American Institute of Metals, Wood further states that for adding iron to nickel alloys, many manufacturers use an alloy of copper-iron-manganese which may vary in composition in the various mills. Thus one of the largest mills uses an alloy containing 86 per cent copper, 4 per cent pure manganese, and 10 per cent iron.

While technically manganese is a very hard metal, its hardening effect on copper does not compare with tin. For example, pure copper has a brinell of 32, an alloy of 90 per cent copper and 10 per cent manganese has a brinell of 45. An alloy of 50.60 per cent copper and 48.40 per cent manganese has a brinell of 71. The 30 per cent alloy of manganese copper possesses the properties of toughness rather than hardness, and has to be cut up by a saw if small amounts are desired. Therefore it is not as convenient in making up weights as phosphor copper or silicon copper which can be broken up easily. Manganese copper can be made into a brittle alloy with the addition of other metals.

Some years ago an alloy was developed and sold for use in red brass. However, the material was offered as a substitute for tin instead of a deoxidizer for red and yellow brass. Manganese was used in the alloy, but the content necessarily was extremely low since manganese would discolor the castings a deep brown.

A manganese alloy that can be used as a deoxidizer for either red brass of the ounce type, or for regular yellow brass, can be made with 14 pounds of 30 per cent manganese copper, 20 pounds of electrolytic copper, 66 pounds of zinc. While this alloy is an excellent deoxidizer for yellow brass, 1 per cent will cause the surface of the castings to be colored brown. If objection is raised to the brown color, less of the alloy may be used.

Book Review

Foundrywork and Metallurgy, Vol. VI, edited by R. T. Rolfe, imitation leather, 238 pages, 5 x 7 inches, published by Isaac Pitman & Sons Ltd., and supplied by THE FOUNDRY, Cleveland for $1.75 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., 416-17 Caxton House Westminster, London.

This is the concluding volume of a series devoted to various factors pertaining to the foundry industry and deals almost entirely with cast iron. Centrifugal casting is discussed by J. E. Hurst and although devoted chiefly to cast iron, deals to some extent with other alloys which have been used in that process. The author discusses the type of equipment used, methods of operation, tests which are employed on the products manufactured by the centrifugal process.

The division devoted to special casting production was prepared by W. Scott and includes information on molding pits, methods of making a marine gearcase, a large hydraulic cylinder, a low-pressure turbine cylinder, a large marine engine bedplate, and a diesel locomotive cylinder block.

R. T. Rolfe and J. Laing collaborated in the preparation of the third division devoted to cast iron specifications and testing. The data presented under that heading of course represents British practice, and a number of the tables presented are abstracted from the British Standards Institution specification No. 321 on general gray iron.

The concluding chapter on alloy cast iron was prepared by the same authors. Information presented includes material on uses and production methods of nickel, nickel chrome and allied cast iron, and a survey is made of cast iron containing other alloy constituents, or those in which a constituent normally present, as silicon or manganese, is to be found in unusually high proportion.

To Handle Equipment

A. G. J. Rapp and C. D. Hollins have opened offices at 7001 North Clark street, Chicago, to specialize in foundry equipment sales and engineering. They will represent the Louden Machinery Co., Fairfield, Iowa, the Royer Foundry & Machine Co., Wilkes-Barre, Pa., and the Royersford Foundry & Machine Co., Royersford, Pa., exclusively to the foundry industry in the Chicago and Milwaukee districts. In addition they will handle ladles, vibrators, etc., and engineer and supply sand handling, sand preparing and mold handling equipment.

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Ottawa, Ill.

New version of the lion and the brave little mouse

The Adventures of Bill

BY PAT DWYER

"SOME day," I said to Bill, "When I have arrived at the stage where I can afford a luxury of the kind, I shall hire a secretary. I have not quite decided whether this secretary shall be a demure little mouse like person, creeping into and out of my presence on tippy toes, or, one of these brisk, efficient specimens, all teeth and shining eye glasses, who will anticipate my every wish and have every job done before I have made up my mind how to go about it."

"A secretary?" Bill echoed in amazement." A secretary? Heaven help all poor sailors on a night like this! You need many things including the glimmerings of common sense and—perhaps—a guardian. What you need, when and if you ever fall heir to enough jack—and that's the only way you'll ever get it—when you arrive at the stage where you experience an overwhelming desire to hire a helper, watch your step, my lad. That's all I have to say, just watch your step."

"What do you mean, watch my step? At one time or another in a varied career I have figured at both ends of the hiring program. I have been hired by all kinds of men, big ones and little ones when I needed a job. Also I have hired men when this item was included in the scope of my duties. True, I never have hired a secretary, but I see nothing alarming in the prospect. Let me ask you one question. Have you ever hired a secretary? No, says you, in a small cringing voice. Then, what do you know about it? Nothing. Furthermore—"

"Never mind furthermore," Bill interrupted. "You're off on the wrong foot, as usual. What I wished to convey is that when you commence talking about engaging a secretary, your people will realize that your mind—never robust at the best of times—has slipped out of gear. A committee of the whole will appoint a delegate to lasso you and lead you off to the booby hatch. A secretary! 'The saints,' as my old aunt Honora always remarked in the face of a real or fancied calamity 'the saints be bechune uz an all harr-um.' Far be it from me to betray any unseemly curiosity, but if you are not under a vow of any kind to conceal your shame, would you mind telling me what put this idea of a secretary in your mind? In the absence of proof to the contrary, or of a statement of any kind, I might fall back on the theory that nature abhors a vacuum. However, in this instance I shall be charitable. Lead on MacDuff! Spill the beans."

"Spoken like a true man and a patriot," I admitted handsomely. "Never shall it be said that I closed my ears to the cry of distress or sent impudent questioners away empty, if I had a stone to throw to them or at them. Know all men therefore by these presents, that this idea of a secretary was prompted by a marvelous publication left today at the door of my humble cot.

"This publication, distributed free, gratis and without a cent of financial obligation on the port of the recipient, is a veritable encyclopedia of useful information, including a full page illustration of the human figure, partly in section to show the wiring system and operating mechanism. The figure is surrounded by the twelve signs of the Zodiac with a long arrow pointing from each sign to a definite section or part of the figure. The accompanying text, in considerable and convincing detail, explains how the life of every person is influenced by the Zodiacal sign under which he or she is born. Thus a person born under the sign of Leo is endowed with strength and courage, while a person born while Capricornus, the goat is in the ascendant will be afflicted with a butt-in, quarrelsome disposition. By the way, what is the date of your birthday?"

Bill did not rise to the bait.

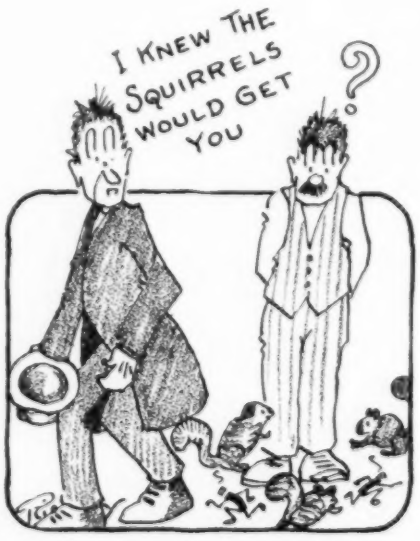
"I don't know what sign I was born under," he said. "Perhaps Aquarius the water bearer. I always have been partial to water—for external use. What puzzles me is how you managed to come into existence under two signs."

"Two signs?"

"Sure, Saggitarius the archer and Taurus, the bull! Shoot away, my lad. What else did you find in this published mine of information?"

"Basing my opinion on the ready manner in which you refer to these characters I should say that the distributor favored you with a copy of the publication. Furthermore, and this furthermore is based on the same assumption, I should say you have been studying the contents diligently. Otherwise how do I find you referring so familiarly to Saggitarius and Taurus? They are not foundry terms."

"They may not be foundry terms," Bill replied with a grin," but believe me kid, shooting the bull is a highly popular foundry pastime. However, to be strictly truthful I have not seen a copy of the immortal publication left at your door, but on the other hand, as you might say, I distributed hundreds of a similar piece of junk for a local druggist when I was a kid and was deeply impressed by the leading illustration. At a pinch I believe I could draw a sketch of the thing now with Aries and Gemini and all the rest of the gang in their proper position. Your pardon, dear lad, for these youthfull



Bill sees his prophecy fulfilled

reminiscences. You were saying something about hiring a secretary to shoot the bull for you, when you become too feeble to draw the long bow yourself."

"If you will be kind enough," I said, "to put away the bow and arrows for a minute and allow a better man a chance to draw a bead on the target, I shall be glad to set you right on this secretary idea."

"Fine work. Now we are beginning to get some where. Fire away and let the arrows fall where they will."

"This publication I am telling you about, contains a calendar. In addition to showing the phases of the moon and other heavenly bodies, this calendar predicts the weather for every day in the coming year. When you consider how frequently the modern weather man with all the resources of the government at his disposal, fails in his predictions from day to day, you will have to admit that this job of predicting a year in advance is a noble undertaking.

"On many occasions in the past, after examining similar publications, I decided to check up the predictions day by day with actual conditions, but for one reason or another the work always was neglected. The urge still persists. Some day I shall hire a secretary whose sole duty will be to write a weather report for the day and compare it with weather predictions in one of these publications."

"Good night!" said Bill, "I always knew the squirrels would get you eventually. However, in the meantime while you still—presumably—are in your right senses I shall be glad to have your comment on an inquiry I had recently from a foundryman who was having trouble with his cylinders.

"He wrote that he was making 24 to 42-inch cylinders. The smaller sizes were quite clean, but the larger sizes show dirty areas where they come in contact with the lower side of the cores. He was thinking of molding the large sizes on end and would appreciate my opinion on the proper type of core and arbor to employ. On a one piece cast iron arbor liberally provided with vent holes what thickness of sand is required to allow for contraction of the casting? What thickness of metal is required in the arbor? The cores vary in length from 8 to 10 feet. Is there an easier or better way to make cores of this kind?

"The method he outlines is feasible for making these cores. Metal thickness in the arbor need not exceed 1-inch. A sand thickness of 3 inches will allow the casting to contract. However, several other methods are available for making cores of the kind described. Without a knowledge of his crane and flask equipment, also the number of castings required, it is impossible to state which method would serve to the best advantage. Following is a brief description of each method.

"1—Regular method praticed in pipe shops. A cast iron or steel arbor equipped with an internal spider and a short projecting spindle at each end is placed horizontally on two suitable stands. The face of the arbor is covered with a layer of hay rope or a special corrugated paper prepared for the purpose. A layer of loam then is applied and struck off to the proper diameter. The core is placed in an oven and dried. Then it is withdrawn, replaced once more on the stands and covered with a coating of thin loam known as *slurry*. The heat in the core usually is sufficient to dry the slurry or at least make it stiff enough to withstand the application of a thick coating of blacking. The entire core then is returned to the oven for a final drying. Where the volume of business warrants the expense and where the mechanical equipment is available, this type of core is superior to any other. It is true to size and accurate and—when made properly—will not cause the iron to boil or bubble in the vicinity.

"2—In a second method, a cast iron arbor provided with vent holes and numerous short dabbers is mounted on a pair of horses. A core frame consisting of two ends connected by two longitudinal members is adjusted in place over the upper half of the arbor. The arbor then is claywashed after which a thickness of sand is packed on the face by hand and mallet. Using the ends or the longitudinal members of the core frame for a guide, the sand is cut or swept to the required shape with a suitable strickle. The partly formed core then is placed in the oven where the sand is dried. It is not dried thoroughly, but just sufficiently to hold it in place when the arbor is inverted and placed once more on the stands. Here the remaining portion of the arbor is covered with sand and swept to the desired shape with the aid of the core frame and strickle as in the first instance.

"3—Where conditions are favorable, the core may be built vertically and directly on the drag. This is the simplest method of all and is particularly applicable in shops with limited crane facilities, or where the men are not accustomed to loam molding. The arbor may be all in one piece or made up of a number of short sections. Where the core oven is high enough the one piece core is the more convenient, but where the core oven is not high enough, the core must be parted.

"Instead of dabbers on the face, the short sections of core arbor are provided with external flanges. A single wrapping of hay rope around the arbor greatly facilitates contraction of the casting and subsequent stripping. Approximately 2 inches of sand is sufficient to ram around the arbor. Where a ring pattern is available the inside and the outside of the mold may be rammed simultaneously. A short pattern may be employed. After each section is rammed the pattern is drawn upward until the mold and core have attained the required length. The cheek part of the mold then is removed and blacked. After the core has been black washed the cheek may be returned to place and the entire mold and core dried as a unit, or, the cheek and core may be loaded individually on the core oven car.

"Whichever type of core is employed, precaution must be taken to see that the vent has opportunity to pass freely from the sand. In this connection it is pertinent to point out that his present trouble—dirt in the drag side of the bore—may be due to a tight or hard core which causes the metal to boil at the first contact."

The only things missing are a few pink elephants

Obituary

F. W. ROGERS, president, Malleable Iron Range Co., Beaver Dam, Wis., died Dec. 19 after an illness of a year. Mr. Rogers was prominent in the range industry for over 40 years and was well known among retailers and manufacturers.

Clement H. Hoppe, 53, president of the C. H. Hoppe Foundry Co., Chicago, died at Chicago Dec. 15.

Louis C. Cowles, vice president and general manager, C. Cowles & Co., makers of automobile hardware, New Haven, Conn., died Dec. 11. The firm of C. Cowles & Co., was founded by Mr. Cowles' father.

Edwin Ruud, 78, president, Ruud Mfg. Co., Pittsburgh, died recently. Mr. Ruud was born in Norway in 1854 and came to the United States in 1882, locating in Pittsburgh a short time later.

Col. Robert L. Streeter, 52, prominent consulting engineer and a former vice president and chief mechanical engineer, United States Aluminum Co., New Kensington, Pa., died at Chicago recently.

Kenneth W. Jacobs, 71, founder and president, Standard Brass Works and K. W. Jacobs Cooperage Co., Milwaukee, died recently. Since his retirement several years ago Mr. Jacobs has resided in Clearwater, Fla.

Chester W. Lasell, president, Whitin Machine Works, Whitinsville, Mass., and nationally known in horseracing circles for many years as breeder, trainer and racer, president of the Trotting Horse Breeders of New England and a former member of the board of directors of the Grand circuit, died Dec. 17, age 72.

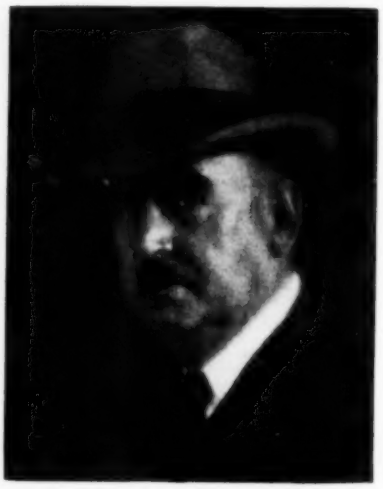
Seabury Smith Gould, 44, vice president, Goulds Pumps, Inc., Seneca Falls, N. Y., died recently. Mr. Smith was a graduate of Hamilton college, and in 1911 entered the sales department of the Gould Mfg. Co., becoming assistant treasurer. Following service in the war he resumed duties, later becoming a director, a vice president, and for the past year serving as secretary.

Addison Herbert Tallman, president, Tallman Brass & Metal Co., Hamilton, Ont., died Dec. 24 at the age of 55. When a young man he became associated with his father and brothers in the business of the Hunter Foundry, which steadily expanded until 1918 when it was incorporated under the name of the Tallman Brass & Metal Co. Mr. Tallman took an active part in civic affairs.

James F. Sprague, 72, founder and president, Sprague Engineering Co., Milwaukee, died recently. Mr. Sprague was a graduate of the Massachusetts Institute of Technology and was associated with the B. F. Sturtevant Co., Boston, and the Automatic Heating Co., Chicago, before becoming chief mechanical engineer of the Bayley Blower & Mfg. Co., Milwaukee. He founded his own firm in 1926.

Frank A. Williams, retired vice president, Youngstown Foundry Co., Youngstown, O., died recently. Mr. Williams was an early associate of George D. Wick in the steel business.

Andrew Thompson, president, Titanium Alloy Mfg. Co., Niagara Falls, N. Y., and prominent in the iron, steel and ceramic fields, died at his home in Buffalo recently. Mr.



F. W. Rogers

Thompson, who was 55 years old, graduated from Princeton university in 1899. From college he entered the employ of the Embossing Co., Albany, N. Y., and at the time of his death was president of that company. In 1912 he became connected with the Titanium company as vice president and general manager. Through Mr. Thompson's efforts, exhaustive analysis and research was instituted which added a wide line of ceramic materials to the products of the company.

Brig. Gen. J. Fred Pierson, 93, president, Ramapo Foundry & Wheel Works, Ramapo, N. Y., died recently at his home in New York. General Pierson was the oldest surviving general of the federal forces in the Civil war and one of the oldest corporation presidents in the United States. He was born in New York on Feb. 25, 1839. In 1857 he enlisted as a private in Co. K of the seventh regiment of the New York national guard. Subsequently he was attached to the staff of Brig. Gen. William Hall. Winning steady promotion through the grades of the First New York volunteer infantry, he attained command of the regiment on Oct. 9, 1862. He was brevetted a Brigadier General on March 13, 1865, "for gallant and meritorious services." During the war he was attached to the Army of the Potomac and took part in most of the army's battles.

Direct Current Secured with Rectifier

A mercury arc rectifier for converting alternating current into direct current recently has been introduced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This rectifier is contained in a fabricated tank of special steel surrounded by a water jacket. Anodes enter from above. The mercury pool or cathode is in the bottom. As the alternating current pulsations are applied to the anodes, the current flashes to the mercury cathode in the form of an electric arc. Removal of the air effects an absolute vacuum within the tank.

High heat evaporates the mercury. This produces surface pressure which sends the vapor rushing upward to the walls of the tank with a speed of approximately 20,000 miles an hour. This tremendous confusion of turbulent whirlpools and eddies has the peculiar characteristic of being a perfect conductor of current from the anodes to the cathode and an equally efficient insulator that prevents the flow of current from the cathode back to the anodes. Consequently, only the positive pulsations of the alternating current pass on to the cathode.

Pictures Show Manufacture of Steel

Six films showing the important operations in the manufacture of steel were shown at the regular meeting of the Philadelphia Foundrymen's association held Wednesday evening, Dec. 14, at the Manufacturers and Bankers club. "The Story of Steel" in pictures was supplied by the U. S. Steel Corp., and included the various steps in the manufacture of pig iron from iron ore, the production of steel from pig iron, in the rolling of rails, plates and bars, the rolling of wire, the rolling of pipe, and the rolling of steel sheets and tin plate. Stanley E. Daut, engineer, Carnegie Steel Co., talked on the major operations shown in the pictures.

Designs Bucket

A new design of elevator bucket for heavy-duty work, which is made of cast Promal, recently has been introduced by the Link-Belt Co., Indianapolis. This bucket includes the following features: Heavy back, heavy lip, reinforced corners, front reinforcing ribs, reinforcing bead around ends and middle of lip raised to reduce digging strains.

GLUTRIN

LIQUID BINDER

IN

BARRELS

Accepted for years by the foundry industry to insure an "even mix" and uniform strength in cores. *Glutrin* is a liquid core binder and can be used in combination with core oils, flour and core compounds. It is not affected by heat or cold and will not deteriorate.

GOULAC

DRY BINDER

IN

BAGS

A core sand binder in powdered form, Goulac is air floated, mixes with sand readily and has great binding strength. Goulac is smokeless both at the oven and mold and cleans easily from the casting. It may also be used for spraying cores, making paste and for a tempering element for dry or green sand facings.

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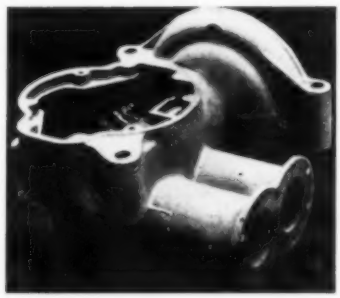
*3

Gate Valve Casting

Mayari added to the cupola mixture makes Castings stronger, better!



Compressor Casting

Spur Gear Castings

SOME of the desirable qualities imparted to castings by Mayari Pig Iron are directly due to the nickel and chromium which Mayari contains. Other beneficial results are not traceable to the nickel and chromium but are due alone to the presence of Mayari in the mixture, and can be obtained in no other way.

Foundrymen are using Mayari so extensively as an agent for improving all types of castings because it offers results possible with no other method. One important reason for the effectiveness of Mayari is the fact that it is a part of the cupola charge, and thus becomes completely and uniformly disseminated throughout the mixture.

Mayari makes castings stronger, tougher, smoother, more resistant to heat, wear and chemical action, closer-grained, easier to machine. The cost of these improvements is so low as to be almost negligible, because the high effectiveness of Mayari makes it necessary to use only a small percentage to obtain the desired results.

BETHLEHEM STEEL COMPANY,

General Offices: Bethlehem, Pa.

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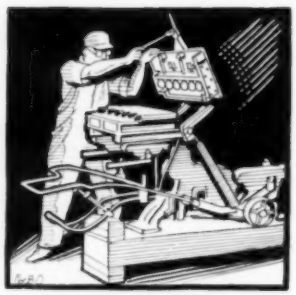
BETHLEHEM STEEL

BETHLEHEM

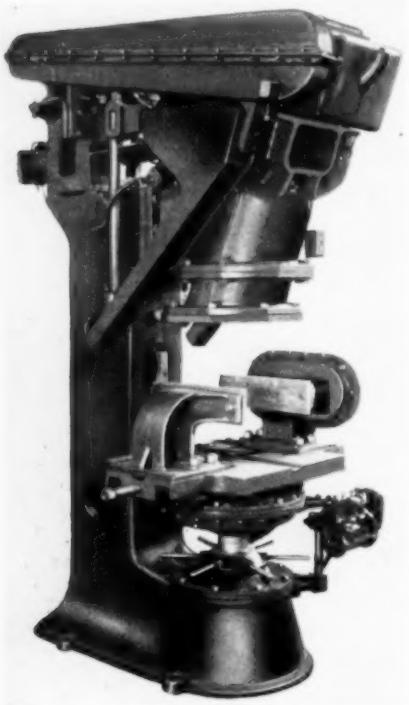
New Equipment



For Foundries

Machine Blows Green and Dry Sand Cores

A new design of machine for the production of cores in green sand or core sand, has been introduced by the Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland. This new machine which is shown in the accompanying illustration will blow cores much



Rotating paddles are used in the sand reservoir

larger and heavier than previously blown.

A feature is the use of rotating paddles within the sand reservoir. These paddles are set in motion during the blowing operation, thereby mixing thoroughly the air and sand. This design is said to increase the blowing efficiency and provide more uniform cores with a minimum of core box venting. Agitation is employed to prevent formation of craters within the sand reservoir, and to permit the blowing of cores of large volume without the presence of pockets or soft spots in any part of the core surface.

The automobile cylinder crank case core shown in the accompanying illustration, has an overall height of 20½ inches and a weight of 80 pounds when blown in core sand. To demonstrate further the ability of the blowing machine, this core also was blown in green sand. Molds in green sand have been blown successfully.

One blowing operation is sufficient to blow completely any core or mold within the capacity of the machine. The cycle of operations requires between 8 and 10 seconds from start to finish. A single operating valve controls all operations of the machine with the exception of the electrically operated rotating paddle mechanism which is controlled by a push button.

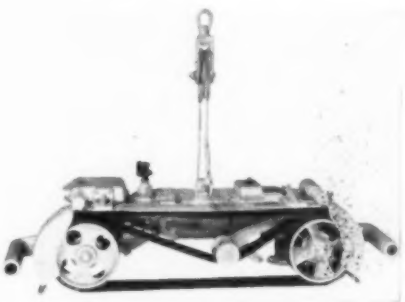
The steps necessary to produce a core are as follows: Place the core box in the machine; close the push button switch controlling the agitator mechanism; turn the handle of operating valve; when the operating valve handle returns to normal position, open the push button switch, remove the core box containing blown core from machine.

Clamping, blowing and unclamping of the core box or flask are controlled automatically by the main operating valve. Both vertical and horizontal clamps of the diaphragm type are employed. The horizontal clamps may be removed quickly to accommodate large horizontally split jobs. All adjustments for core box or flask space may be accomplished with only one wrench. A safety device prevents the blowing operation from taking place at any time when a core box or flask is not in place.

This core, blown on the machine, weighs 80 pounds

Belt Sander Has High Frequency Motor

Buckeye Portable Tool Co., Dayton, O., has introduced several new electric portable tools having a specially designed high frequency motor. One of the tools, a high-frequency belt sander shown in the accompanying illustration, features a single motor drive. The sander is cooled by compressed air, which is claimed to increase the efficiency of the tools by preventing dust or grit from entering the motor. Compressed air also is used for the automatic belt tension. By use of a belt idler, it is possible to use manufactured abrasive belts over an endless leather belt. A specially designed high frequency motor also is being used on a new cup wheel grinder. This grinder is used for resurfacing large castings, welded seams, dies and flat metal.



The belt sander, having a single motor drive, is cooled with compressed air

Tires for Wheelbarrows

The B. F. Goodrich Co., Akron, recently has designed a low pressure tire for wheelbarrows. It is pointed out that the new tires, patterned after airplane casings, permit the use of the wheelbarrow in mud or deep sand with greater ease.

For 1933

make it a

CAST IRON

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Produce castings that better withstand abrasion. Add "Nichrome" B to your ladle of Cast Iron.

Reduce porosity—strong light weight non-porous refrigerator compressor castings have resulted from "Nichrome" B addition.

Increase their hardness—"Nichrome" B addition has helped in making airplane motor cylinders with greater hardness.

MODERN demands of castings have been satisfactorily met by those using "Nichrome" B additions to their cast iron.

Tougher, stronger, easily machined castings represent an extension of general foundry practice.

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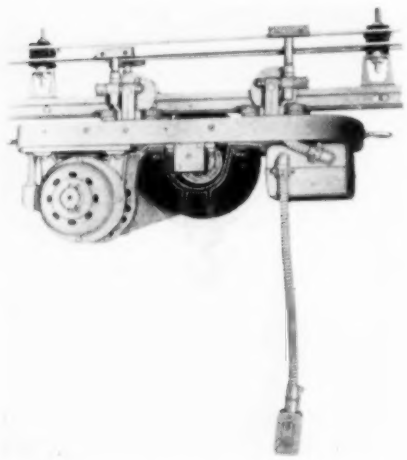
"Certified" Steel Abrasives are recommended by leading Blast Cleaning Manufacturers

Trolley Is Driven Through Single Wheel

American Monorail Co., 13107 Athens avenue, Cleveland, has introduced a new motor driven trolley which features the use of an air or live rubber wheel to drive the bottom of the monorail section. The high coefficient of friction between the wheel and the rail is said to give a nonslipping grip against the steel rail section, resulting in a powerful drive unit. Structural simplicity is



The wheel, equipped with a rubber tire, operates on the under side of the rail

obtained by driving one wheel. The same type of drive is applied to cranes and is said to show the same operating advantages.

The latest design of motor reducer units featuring compactness, low cost and availability in all current characteristics and voltages as well as speed reduction ratios is used in the new equipment. Where close control is required, variable and multi-speed motors may be used, but on a great many applications, due to high traction between the wheel and the rail, it is now possible to use the simpler squirrel cage type motors.

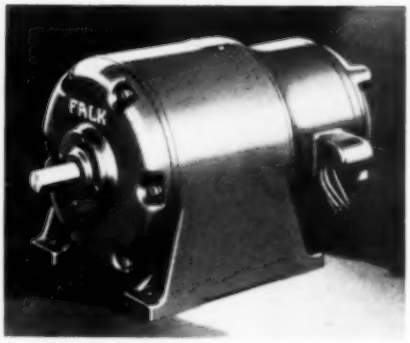
The new drive is said to permit the use of power travel on narrow flange rails. It also permits the application of power travel to existing track systems having limited throw switches. Since the traction is obtained by pressure entirely independent of the load, it is practical to haul long trains of carriers without unduly weighting the drive wheels to obtain the required traction.

Combines Motor And Speed Reducer

Falk Corp., Milwaukee, has developed three styles of a combined motor and speed reducer which it is claimed retains the advantages of separate motors and speed reducers and, at the same time, gives increased compactness, simplicity and economy. A gear housing acts as a support for the motor, thus giving the necessary rigidity.

In the integral type the motor end bell is removed and the motor close coupled through a bayonet type of joint to the gear case. In the flexible type the round frame type of motor is used and the end bell retained.

All three types are supplied in horsepowers from $\frac{3}{4}$ to 75, with ratios from 4.6 to 288. Nonplanetary, helical type gears are used throughout. A view of the integral type is shown in the accompanying illustration.



The motor is close coupled through a bayonet type joint

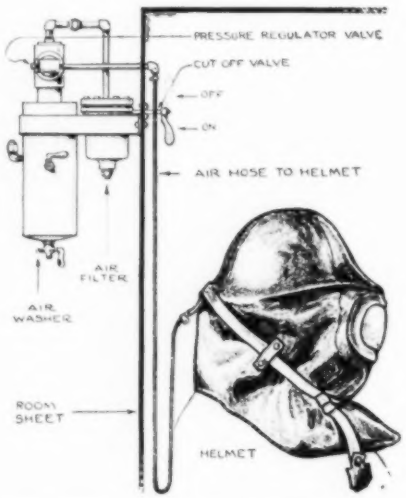
Safety Features Included in Helmet

Pangborn Corp., Hagerstown, recently has introduced a new type of blast cleaning helmet which embodies numerous safety features. A generous supply system provides the operator with a continuous stream of cool, deodorized, washed air. Pressure of the flow is regulated easily to satisfy the personal breathing requirements.

Special care has been taken in the design to prevent the seepage of dust into the helmet. A soft rubber tire holds the vision window glass in a secure, air tight grip. Nevertheless, the operator may remove or replace the glass quickly when necessary. Seepage of dust from underneath the rubber cape which covers the operator's shoulders is prevented by a cape which is attached securely beneath the exterior rubber cape. Draw strings are provided, which form the interior cloth cape snugly under the operator's chin, as shown in the accompanying illustration.

The helmet is provided with a special sweat band which is adjustable to any size or shape of head. A second comfort feature is the adjustable skull cap for raising or lowering the helmet. Every exposed part of the helmet, except the screen vision protector, is of rubber.

The operator receives the air from a filter and air washer, which is shown in the accompanying illustration. Air from the compressor is piped through the air filter where it is deodorized and purified. It then is passed through a washer and is freed from dust and impurities and the air temperature and humidity adjusted to secure the highest efficiency of the operator. The air then is admitted to the helmet.

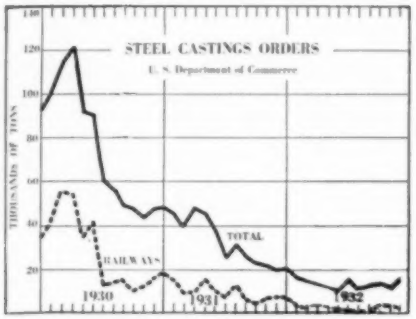


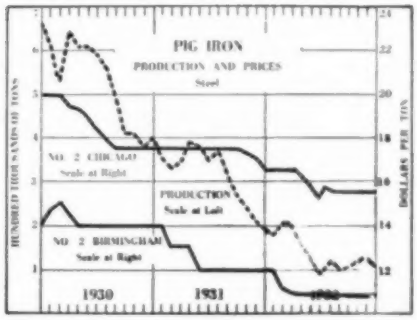
The filter and washer may be attached to the exterior wall of the blast room

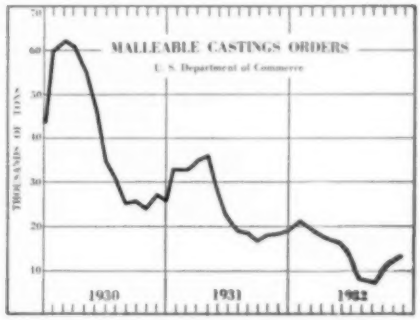
Manganese Welding

General Electric Co., Schenectady, N. Y., has introduced a new coated electrode for manganese welding. The new wire finds its principal application in the building up of worn manganese steel castings to original dimensions and in the repair of fractured parts. It also may be applied to obtain a manganese steel surface on parts of ordinary steel and iron, thereby giving the parts a tough, work-hardening, wearing surface.

Adjustable skull cap and sweat band brings vision window to correct position







Foundry Activities

Reflect Industrial Trends

W. O. LARSON FOUNDRY CO., Cleveland, has been incorporated with the following officers: President, W. O. Larson, vice president, R. B. Montis, and secretary and treasurer, W. A. Dennison. The principal offices will be in Cleveland with plant located at Grafton. The plant is a large modern foundry purchased from the Osborn Mfg. Co., Cleveland, and is well equipped. The company will offer a general line of jobb ng castings.

* * *

Turner Foundry & Machine Co., 917 West Schiler street, Philadelphia, was damaged recently by fire.

* * *

Perfect Circle Co., New Castle, Ind., is installing an electric furnace and will refine cupola metal for piston rings in the new unit.

* * *

Peerless Foundry Co., 1853 Ludlow avenue, Indianapolis, has installed a new downtown show room at 207 East Washington street.

* * *

Noel E. S. Pettit will build a pattern shop at 920 Dufferin avenue, London, Ont., for the manufacture of foundry patterns.

* * *

Syracuse Chilled Die & Casting Co., Syracuse, N. Y., suffered loss of its office building by fire recently. The main plant was little damaged by the fire.

* * *

Emery Pipe & Foundry Co. Inc., Anniston, Ala., has been granted a 5-year exemption from taxes on its plant, which will be constructed immediately. The company succeeds the Emery Foundry Co., whose plant was destroyed by fire in June. The company is capitalized recently at $80,000.

* * *

Baird Machine Co., Bridgeport, Conn., has plans for two 1-story additions to its plant at Stratford, Conn., 33 x 100 feet and 100 x 100 feet.

* * *

Western Steel Casting Co. Tacoma, Wash., has been incorporated to fabricate steel and iron products, by M. S. Alexander and associates.

RAW MATERIAL PRICES
Jan. 9, 1933

Iron	
No. 2 foundry, Valley	$14.50
No. 2 Southern, Birmingham	11.00
No. 2 foundry, Chicago	15.50
No. 2 foundry, Buffalo	16.00
Basic, Buffalo	15.50 to 16.00
Basic, Valley	14.00
Malleable, Chicago	15.50
Malleable, Buffalo	16.50
Coke	
Connellsville beehive coke	$2.50 to 4.25
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$8.25 to 8.75
Heavy melting steel, Pitts	8.00 to 8.50
Heavy melting steel, Chicago	5.00 to 5.50
Stove plate, Buffalo	7.50 to 8.00
Stove plate, Chicago	4.50 to 5.00
No. 1 cast, New York	5.50 to 6.00
No. 1 cast, Chicago	5.50 to 6.00
No. 1 cast, Pittsburgh	8.50 to 9.00
No. 1 cast, Philadelphia	9.00 to 9.50
No. 1 cast, Birmingham	9.00 to 9.50
Car wheels, iron, Pittsburgh	7.75 to 8.00
Car wheels, iron, Chicago	7.00 to 7.50
Railroad malleable, Chicago	5.50 to 6.00
Agricultural mal., Chicago	5.00 to 5.50
Malleable, Buffalo	8.00 to 8.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	4.75
Straits tin	22.50
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt Cleveland	8.00 to 9.00
Lead, New York	3.00
Antimony, New York	5.45
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.10

Henderson, Carnahan & Thompson are attorneys for the company.

* * *

Excelsior Novelty Casting Co. has been incorporated with $10,000 capital to operate a foundry, by M. Friedman, 478 East Tremont avenue, New York.

* * *

Atlas Brass Foundry, 980 South Front street, Columbus, O., was damaged by fire to the extent of about $2500. J. P. Salter is manager.

* * *

L. J. Zerbee of Zerbee Mfg. Co., has bought the plant of the former Fisher Brass Co., Bellefontaine, O., and will occupy the property for the manufacture of ornamental bronze and iron.

* * *

Nordberg Mfg. Co., 3072 South Chase avenue, Milwaukee suffered loss by fire recently to the extent of about $10,000 to stock and pattern storage.

* * *

Wheatley Bros. Tulsa, Okla., have established a branch machine works and office at Longview, Tex., to serve the East Texas oil fields. Thomas Wheatley, Tulsa, Okla., is general manager.

* * *

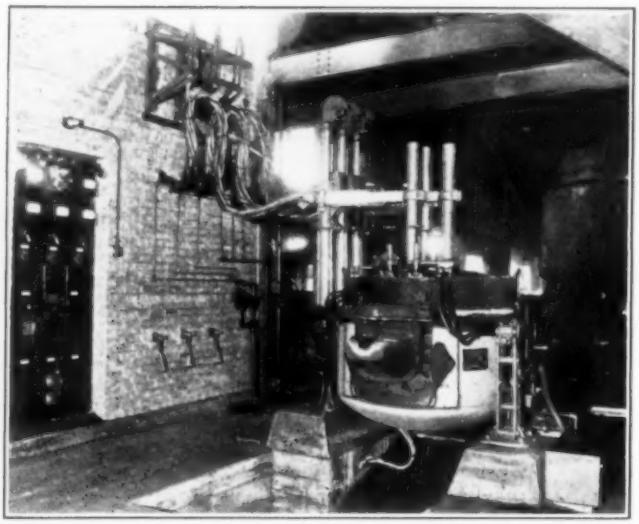
Sivyer Steel Casting Co., 1675 South Forty-third street, Milwaukee plans to replace an old melting unit by an electric furnace at cost of $25,000 to $30,000 Lamar S. Peregoy is president.

* * *

Central Die Casting & Mfg. Co. Inc., 2935 West Forty-seventh street, Chicago, has been incorporated to manufacture products of iron, steel nickel and other metals, by James M Hopkins Jr. and associates. Winston,

MOORE RAPID Lectromelt FURNACES

The Most Rapid and Economic Electric Furnaces for the Melting and Refining of Gray and Malleable Irons, Carbon and Alloy Steels.



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The cost of steel castings to your customers is the purchase price plus the finishing cost. When your customers find their finishing costs too high, a reflection is made upon the quality of your castings, *regardless of their purchase price.*

When you use Ferro Carbon-Titanium in the ladle, you often reduce your customers finishing costs. A small percentage of Ferro Carbon-Titanium added to the ladle yields a more uniform surface and prevents segregation and dirtiness.

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GREAT BRITAIN AND EUROPE
T. Rowlands & Co., Ltd., Sheffield, Eng.

Strawn & Shaw, First National Bank building, are correspondents.

* * *

United States bureau of reclamation, Denver, Colo., will ask bids about March 1 for about 2000 tons of base and inlet castings for intake towers, cast iron and steel for Boulder Dam.

* * *

Sibley Mfg. Co., 220 West Eckman street, South Bend, Ind., will rebuild its burned motor-casting plant immediately. Plans have been completed and construction is to be started at once.

* * *

Sorel Steel Foundries, Sorel, Que., has installed a 3-ton electric arc furnace for basic operation on manganese steels, alloy steels and plain carbon foundry steels. The installation has just been completed and goes in as a converter replacement.

* * *

Gordon Steel Works, Tweed, Ont., was damaged by fire Dec. 16 with loss to building and equipment of $100,000. Officials have no intention of rebuilding at present, but may salvage some equipment and ship it to the Hamilton, Ont., plant.

* * *

Production of gray iron and steel castings in the Philadelphia Federal Reserve district was larger in November than in the previous month, according to a report of the Industrial Research department of the University of Pennsylvania.

* * *

East Boston Brass Foundry has started operations at 155 Border street,, East Boston, Mass., operating a job casting shop. The company occupies a story and a half building containing about 4000 square feet of floor space. Harry F. Russell is president.

* * *

Beaver Dam Pattern Co., Beaver Dam, Wis., has applied to the Wisconsin public service commission for permission to issue $50,000 in common stock, the proceeds to be used for expansion of the business and purchase of additional machinery and raw materials.

* * *

Gray Iron Institute, Inc., 4300 Euclid avenue, Cleveland, reports a slight decline in all classifications during November. Production was on the basis of 36 per cent of normal compared with 40.9 per cent in October and 37.1 per cent in November, 1931.

* * *

Horseheads Foundry Corp., Horseheads, N. Y. has leased the plant of the Reeves Foundry Co., and will manufacture valves and meter boxes, starting operations early in 1933. W. J. Gibney, former vice president of the Chemung Foundry Corp. Chemung, N. Y., is head of the new company.

* * *

Big Rock Foundry Co., Chesaning, Mich., has been formed with Louis Bila president, Bert Coke vice president and Allen Swartzmiller secretary-treasurer. A warehouse 36 x 40 feet is being built for tool and grinding rooms and machine shop and a new cupola is to be added. Plow points form the production of the foundry.

* * *

Gilbert & Parker Mfg. Co., West Springfield, Mass., has reopened its foundry plant and recalled 100 employes after a shutdown of nearly 3 months. The company produces gasoline pumps, range burners and oil burners. The new schedule, made possible by an increase in orders unusual in December, will enable the department to run on the present schedule well into 1933.

* * *

Columbian Vise & Mfg. Co., 9021 Bessemer avenue, has delivered vises made of a cast light aluminum alloy for installation in the tool room of the *Macon*, now under construction at Akron, O., according to H. F. Seymour, vice president. The alloy, developed with the assistance of the United States Aluminum Co., made it possible to reduce the weight of the vises 50 per cent without loss of efficiency.

* * *

Pierce, Butler & Pierce Mfg. Corp., Syracuse, N. Y., manufacturer of cast iron boilers, steel radiators and similar equipment, has filed a voluntary petition in bankruptcy. Irving N. Beeler, president, has been appointed receiver. Reorganization is expected to follow. The corporation, having assets of $10,500,000 was organized in 1914, operating plants at Syracuse, Oswego and Eastwood, N. Y., Huntington, Pa., and Zanesville, O.

* * *

Foundry of the J. C. Stine Co., Tyrone, Pa., practically was destroyed by fire Dec. 17 with loss estimated to be $200,000. The company had one cupola for gray iron castings production and a brass crucible furnace in addition to its own machine shop and pattern shop. The plant had not been in operation for several months but a maintenance crew of about 50 men was being maintained.

New Trade Publications

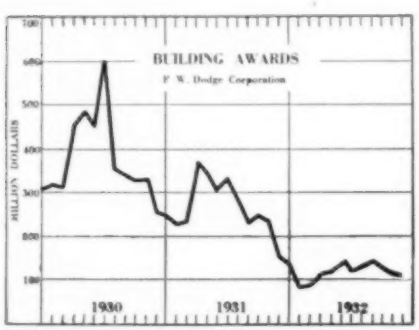
ELECTRODES — Welding electrodes and accessories are described in bulletin GEA-1546, which is published by the General Electric Co., Schenectady, N. Y.

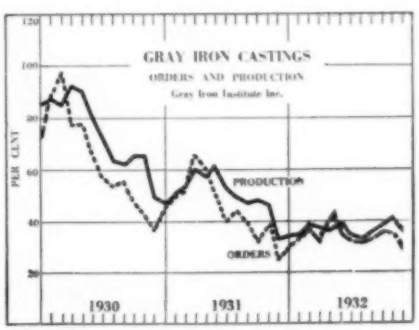
AIR HEATERS—Ludwig Hommel & Co., Rose building, Cleveland, has published a folder illustrating and describing uses for an electric air heater which is manufactured by Ewin L. Wiegand Co., Pittsburgh.

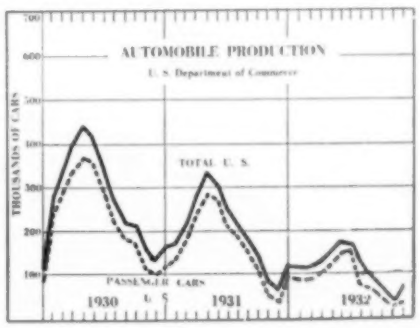
CRUCIBLES—Lava Crucible Co. of Pittsburgh has announced in a recent bulletin the application of automatic machine control to every stage in the manufacture of crucibles. It is pointed out that machine control provides uniformity, safety and endurance and leads to metal purity.

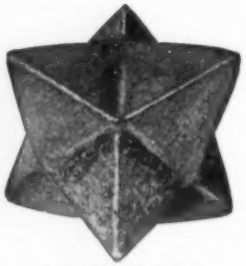
FLUID METERS—Bulletin No. 300 describing a new line of fluid meters has been published by the Bailey Meter Co., Cleveland. The bulletin describes and illustrates the several types of meters which can be supplied, pointing out the distinctive features of the line. Other sections of the bulletin deal with the application and methods of installation of the equipment.

ACIDSEAL PAINT—B. F. Goodrich Rubber Co., Akron, O., is distributing a sales manual section devoted to acidseal paints which have as a base a commercial form of rubber isomer, development of the Goodrich laboratory. Special features claimed for the paint are exceptional properties of adhesion when properly applied, drying in one hour to a hard film but retaining to a remarkable degree the elastic properties of rubber, retaining the chemically resistant properties of rubber and providing a protective coating that minimizes the corrosive action of acids, alkalies and chemical fumes. The film is not water absorbent.









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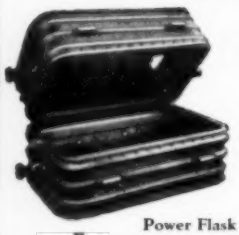
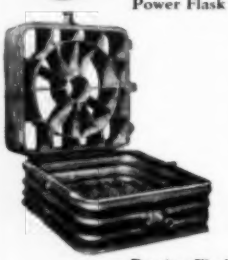


Power Flask



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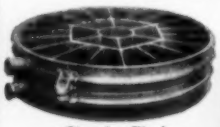
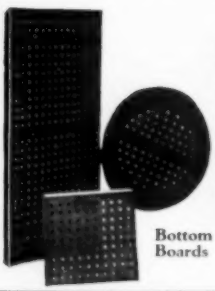


Circular Flask

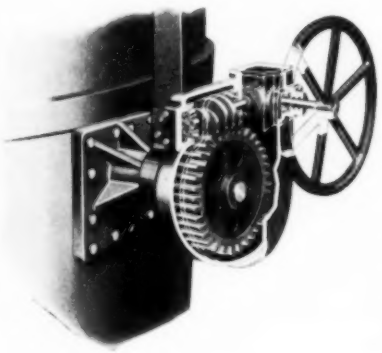
Two-Man Flask



Bottom Boards

Core Rack

FOUNDRY EQUIPMENT



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..THE patented features in our new Geared Ladle eliminates all trouble from binding or sticking gearing. In this design the gearing has no connection with the Bail whatsoever assuring alignment of gearing regardless of distortion or springage of the Bail or Bowl or both from heat. Accurate pouring, no drops, no jerks, and exceptional long life are other distinctive features in this design. Furnished manually or electrically operated. *Write for descriptive literature.*

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By H. A. Schwartz

This book is the first complete treatise on "black hearth" malleable iron ever published.

It covers the history of the malleable industry—its development, modern methods of manufacture, metallurgical principles involved and the properties and uses of American malleable cast iron. It also includes a detailed bibliography in which all the important books and articles published pertaining to malleable iron are listed and represents the only reference work available on the subject.

While written primarily for the producer and user of malleable castings, this book is also adapted to the needs of the technical student and the library.

"American Malleable Cast Iron" is the only book on malleable iron in print.

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